Tractatum hunc cui titulus

The Anatomy of the BRAIN;

Dignum Judicamus qui Imprimatur,

Thomas Burwell, Præſes.
Samuel Collins,
Fred. Slare,
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} Cenſores.

Dat. ex Ædibus Collegii in Comitiis Cenſor. Sept. 7. 1694

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THE ANATOMY OF THE BRAIN.

Containing its
Mechaniſm and *Phyſiology*;
Together with ſome
New Diſcoveries and Corrections
OF
Ancient and Modern Authors
Upon that SUBJECT.

To which is annex'd a particular Account of
ANIMAL FUNCTIONS
AND
Muſcular Motion.

The Whole illuſtrated with Elegant Sculptures after the life.

By *H. RIDLEY*, Coll. Med. Lond. Soc.

LONDON:
Printed for *Sam. Smith* and *Benj. Walford*,
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Spectatissimo Doctissimoque Viro

D. D. JOHANNI LAWSON

Collegii Regalis Medicorum London.

Presidi Dignissimo

SOCIIS,

Et inter eos speciatim

CENSORIBUS

Vel eo nomine Clarissimis

SAMUELI COLLINS,
RICHARDO TORLESS,
EDVARDO TYSON,
MARTINO LISTER.

NECNON

D. D. Electoribus Meritissimis

Omnibus & Singulis.

Tam præ Universali Exquisita sua eruditione, quam Artis Apollineæ *Praxi felicissima longe Celeberrimis*

CÆTERIS Denique,

Egregiis Viris

Inclytissimæ hujus Societatis ascriptis

Paginas has eorum jussu in lucem prodeuntes,

Honoris & Obsequii Ergo
quam Humillimè Offert,

H. R.

THE

PREFACE

TO THE

Reader.

THAT Reaſon which, upon firſt thoughts, ſeemed of moſt force to diſſwade me from engaging my ſelf upon the Subject I have made choice of in theſe few following Sheets, (which was, its having been already undertaken by two ſo eminent Perſons, as the late *Willis*, and the preſent *Vieuſſenius*) upon ſecond became the greateſt motives to it. Seeing that even after the beſt Proofs they have either of them been able to give of *Skill*

or *Induſtry* upon this Subject, there hath yet eſcap'd undiſcover'd both a great deal of the Materials which Nature is wont to furniſh for the framing of Parts, and Contrivance too in ranging of them, in order to bring about that great deſign of making them all contribute their ſhare to the conſervation of the whole.

The truth of this becoming ſtill more evident whilſt I became more converſant in *Diſſection*, after ſome time, put me upon an endeavour, by a deeper Scrutiny, to diſcover ſomething more than what as yet had come to light: and this I undertook ſo much the more vigorouſly, as by how much I reckon'd it more preferrable to contribute my Mite towards the perfecting of a Work already ſo happily begun

gun and ſucceſsfully carried on, than to break the Ice only (the common Fate of the firſt attempt) of another. With what ſucceſs I have done it the Reader muſt be Judge.

Through the whole deſcription of Parts I have offer'd nothing but Matter of Fact, and have taken all poſſible care to avoid being impos'd upon my ſelf, by making Experiments in proportion to my Doubts. Some of them have been upon Subjects in their natural, ſome in their morbid eſtate, ſome upon thoſe of Untimely Death; and on thoſe laſt ſometimes whilſt the natural Fluids remained in their proper Veſſels, though after a preternatural manner occaſion'd by Strangulation; ſometimes when in the room thereof, other Bodies have been introduc'd by

by Injection, as *Tinged Wax* and *Mercury*, the first of which by its consistence chiefly, the other by its permanent nature and colour, contribute mightily towards bringing to view the most minute ramifications of Vessels, and secretest recesses of Nature.

By this various disposition of the Subject it is that so great Difficulties are overcome in search after Truth, many things appearing oftentimes very plain in one state, which either lay concealed, or seemed otherwise modified in any of the other.

The Figures were delineated by the hand of that Compleat Anatomist Mr. *Cowper* the Surgeon, whose great Skill in Dissection renders that Talent so fortunate both to himself and his Friends: and how exactly that

that Work is performed, I ſubmit to the Severeſt Cenſure of any who will be at the pains to compare any of the Cuts to the life.

What I have ſaid upon the *Phyſiologia*, in relation to *Nutrition* and *Muſcular Motion*, depends on Microſcopical Obſervations; and as to the *Poſtulatum* on which they both depend, though at firſt ſight it may appear ſurprizing, yet I am confident it will become far leſs ſo to thoſe who have been acquainted with what hath been ſaid of the Vaſcular Compages of Plants by *Malpighius* and *Grew*, and of ſeveral other Subjects by *Lewenhoeck*.

And to conclude, I muſt confeſs I have been the better ſatisfied with it my ſelf, ſince I met with ſome Paſſages in the Works

Works of thoſe learned Micrographiſts Dr. *Power*, and of Mr. *Hooke*, relating to this Subject, in which laſt, the *medium* made uſe of for ſolution of that famous *Phœnomenon* of the Plants contraction at the firſt appulſe of Touch from external Objects, as well as the manner of its acting, is the ſame with that made uſe of here as a *Poſtulatum*, upon which the whole of what is ſaid about *Muſcular Motion* is built: Altho' at the ſame time I am ſenſible 'tis not ſo apply'd in that place by the aforeſaid Author, whoſe opinion in reference to *Muſcular Motion* (being the ſame with that of Dr. *Mayow* already taken notice of in the following Sheets) is expreſly otherwiſe in the account he gives of thoſe natural *Hygrometers* the Beards of *Wild Oats*, of all the ſorts of *Cranes Bills*

and

and *Cats Guts*, conformable to the manner of Nature's acting on which, in order to make them proper *Indexes* of the various Changes of Weather (*viz.* by *wreathing* and *unwreathing*) he ſuppoſes that to be of *Muſcular Motion*.

I have quoted Authors, not out of oſtentation, but both for their Truth and Errors, to the end that at the ſame time we may ſee it reaſonable and convenient to read all they ſay, we may be render'd cautious how we believe; and to put us in mind, that as we find ſomething done to our hands by thoſe who have gone before, there is reaſon we ſhould do ſomething for thoſe who are to come after.

THE

THE
INTRODUCTION.

HOwſoever *the* Controverſie *may ſtand amongſt Learned Men, about the Method and Order which* Nature *makes uſe of in the framing the different Parts of Animals, eſpecially as to precedency of Time, ſome of them ſuppoſing a rudimentary delineation, or pre-exiſtence of the whole, which, as the Ingenious* Bruner *hath rightly obſerved, muſt neceſſarily imply an actual exiſtence of the whole Race of Mankind at once, either in the* Teſticle *or* Ovarium *of* Eve, *according to the Learned* Harvey, Malpighius, Swammardam, &c. *or in that of* Adam, *according to* Lewenhoeck, *Dr.* Garden, *and ſeveral others, and conſequently muſt needs alſo infer an extinction of the ſame Progeny, as ſoon as the number of thoſe humane* Germens *or* Animalcles *ſhall be exhauſted; others a gradual formation of parts,*

one

one after another, by an inteſtine motion begun and carried on from the time of coition, by the ſubtle matter *in the* Cicatricula *of the Egg: I ſee no reaſon to make my ſelf a Party on either ſide at this time, ſeeing the fineneſs of ſtructure and dignity of functions are ſufficient to give preference to one above another, and to render it more worthy of a particular conſideration. And this part I take to be the* Brain, *the delicacy of whoſe ſtructure is ſuch, that with no little reſemblance to its divine Author, whilſt it gives us the greateſt and cleareſt diſcoveries of other things, lies moſt concealed it ſelf.*

And ſeeing all that Myſtick Knowledge, *which in ancient times, in the eyes eſpecially of the Vulgar, appeared meer* Necromancy *or* Witchcraft, *as well as all the* Curious Diſcoveries *of more modern Ages upon the whole ſubject of Nature, now going under the more familiar and proper term of* Refined Sence, *or* Philoſophy, *hath been meerly owing to a more acurate knowledge of the parts and modification of Matter, I ſee not any more likely way of conquering the difficulties yet be-*

behind upon any particular ſubject, than the endeavouring after a further and more nice ſcrutiny into it by ſuch means and experiments as ſerve to bring its moſt minute parts and texture under the teſt of Sence, which ſo aſſiſted, doth the ſame office to the diſcerning faculty as good artificial Glaſſes do to it, bringing the Object and Judgment to ſuch a nearneſs, that even the firſt Link of the Chain becomes diſcernable, and the mechanical proceedings of Nature ſo highly inſtructive to the Underſtanding, *in its finding out and aſſigning proper Cauſes to Effects much more obvious and intelligible.*

I ſhall therefore treat this Noble Part after the aforeſaid manner, with all the Juſtice I can, leaving thoſe inviſible, and almoſt divine things called Animal Spirits, *to be treated of more at large, by thoſe more illuminated* Philoſophers, *who ſee beſt when their Eyes are ſhut, and content my ſelf with making an inquiry into, and giving a deſcription of, whatſoever upon this Subject, by Diſſection, ſhall offer it ſelf as an Object of our Senſes.*

THE

THE ANATOMY OF THE BRAIN.

CHAP. I.

Of the Anatomy of the Brain.

THE topmoſt part or *Olla* of the *Cranium* being removed, the firſt part of the *Brain* that comes in view is the *Dura Mater*, which, with the ſubjacent *Pia Mater*, is accounted only an *improper part of the Brain*, ſtrictly ſo called, however of great uſe in many reſpects to it.

'Tis by *Spigelius* and other Anatomiſts reckon'd, and I think not undeſervedly, the thickeſt and hardeſt Membrane of the whole Body, encloſing the whole Brain, properly ſo called, ſomewhat looſely, ſticking al-

moſt inſeparably to the *Baſis* of the *Cranium*, and to the top and ſides, under the Coronal, Sagittal, and Lamdoeid Sutures, very faſt by the *Sinus's* whoſe deſcription will come in another place.

In ſome places of the upper part of the *Cranium*, which on each ſide of the Sagittal Suture or Vertex are called *Oſſa Bregmatis*, it adheres not to the Bone, notwithſtanding the poſitive Opinion of *Van Roonhuyſe*, in his Letter to *Du Foy*, to the contrary, who for that very reaſon would fain take away in a great meaſure the uſe of the *Trepan* and *Trefoyne*, and altogether the uſe of the Inſtrument called *Decuſſorium*, which skilful Surgeons do often make uſe of to make room for the diſcharge of ſubſided matter below the fractur'd place in many Accidents of the Brain. *Roonh.* p. 149.

'Tis very diſcernably double, as *Columbus* and ſeveral others formerly, and *Vieuſſenius* lately, have obſerved, having very ſtrong and large Fibres on the inſide, but very ſmall, and hardly viſible, on that ſide next the Skull; as appeared to me, after having firſt let it lye a little time in boiling or at leaſt very ſcalding Water. *Col.* p. 348 *Vieuſſ.* p. 3.

But

But as to the distribution of the double sort of Fibres on each side this Membrane, I could not by any means find them agreeing with the description *Vieussenius* hath given of them, as running in an oblique semicircular manner, externally from before backwards, and in the same figure internally from behind forwards; but far otherwise, on the inside, where they are very strong, they seem manifestly to have three originals from the top part of the *Processus Falcatus*, before, behind, and in its middle; those before running in a curved manner backwards, half the length, and a great width of the *Dura Mater*, and those behind running after the same manner forwardly with this difference, that a great number of them bend soon after their rise from that process in a kind of a semilunary way to it again a little on this side the rise of the middle *Series* of Fibres, others of them making a bigger arch after having stretched themselves wider upon the *Dura Mater*, bend back again to, and terminate in the Falx a little beyond the rise of the aforesaid middle *Series* of Fibres.

Thoſe from the middle part of the Falx run backwardly, but leſs curved than the reſt, terminating as the Fibres which ariſe backwardly do, at ſome diſtance from the Proceſs in the inward Superficies of the *Dura Mater*.

As to thoſe belonging to the exernal ſide or ſecond *Lamina* of the *Dura Mater*, they are extream ſmall and obſcure, running from behind forwards.

Beſides theſe, there are no leſs remarkable ones belonging to the Falx it ſelf, of two ſorts of Orders, the one running ſtreight about half the length of it, on its upper part, from before backwards, the other tranſverſe, from the inferiour or fifth *Sinus* to the ſuperiour or third, on the hinder part of the Proceſs, and are moſt conſpicuous there, as the other are towards its foremoſt part.

As to the Uſe of theſe Fibres, it may be remembred that this Membrane conſiſts of two *Lamina's*, between which the Veins which reduce the Blood from the Arteries, which furniſh the whole Brain with it, run for ſome ſpace after the manner of the Ureters in the Bladder, in large Trunks,

Trunks, before they enter the *Sinus*; ſo that the Fibrous Conſtitution of this Membrane here, where the Blood-veſſels are largeſt (together with the curved entrance of them into the *Sinus*, eſpecially in an erect poſition of the Body) do the office of Valves, ſupport the weight, and promote the aſcent of the Blood. But that which is moſt conſiderable, is this, That if the inward *Lamina* of this part, which makes the inferiour and lateral part of the *Sinus*, was not in ſome meaſure furniſh'd with additional ſtrength on this ſide ſuitable to that which it hath on the other, by reaſon of its coheſion to the Skull, the Blood which is continually running through it with no ſmall rapidity, eſpecially in great plenitude of the Veſſels or preternatural Ebulitions, would frequently burſt out, or at leaſt cauſe ſuch diſtentions as could not but be very injurious to a part ſo very exquiſitely ſenſible; yet notwithſtanding, tho' Nature ſeems plainly to have made a double proviſion againſt ſuch Accidents, by the tranſverſe Ligaments within the *Sinus*, and theſe ſtrong and numerous Fibres without, I have rarely open'd any ſtrangled

Body, where ſome ſuch Rupture, or at leaſt Diſtention, hath not hapned.

This Membrane hath plenty of Nerves from the foremoſt Branch of the fifth Pair, and is thereby made very ſenſible, ſo that from any moleſtation given it by the ill *Craſis* or undue motion of the Blood, it becomes accordingly affected. And as the various diſtribution of Fibres before deſcribed ſerve in a natural eſtate to give a kind of ſpringineſs to the Veſſels, whoſe Coats are extended by the Blood as they run between the *Laminæ* of this Membrane, to the end the ſame may be the more readily circulated through them; ſo in a preternatural eſtate, no doubt, they are ſubject to Spaſms, which may retard the courſe of the Blood in ſuch ſort, that in ſome kind of violent Headachs, where the Membrane is affected through overfulneſs of Blood, and particularly in thoſe which are wont to proceed from Vapours (ſo called) or Convulſive Motions of Nervous parts, we often obſerve a fixed ruddineſs in the Face, attended with a kind of ſtiffneſs and ſoreneſs in the Eyes, proceeding doubtleſs from a ſtagnation in ſome meaſure of the

Hu-

Humours in those parts, through the too slow passage of them into the reductory Vessels or *Sinus's*. And to this preternatural affection of the *Sinus's* may certainly many other ill Symptoms of the Brain be imputed, and not to any irregular *Systole* and *Diastole* of the Membrane it self, occasion'd through any convulsive or paralytical state thereof, as that curious Speculatist Dr. *Mayow* hath affirmed, seeing not any living Dissection hath ever been found to give Authority to any such Hypothesis. *Mayow*, Tr. 4. p. 49

The First Process of the Dura Mater.

It hath two Processes, the first of which arises from that part of the *Os Ethmoeides*, called *Crista Galli*, and is extended from thence backwards, as far as the concourse of the four greater *Sinus's*, commonly called *Torcular Herophili*, in the figure of a Sicle, whence it hath that denomination of *Falx*, and by reason of the strict connexion it hath by certain Membranous Fibres with the *Cranium* in those places which are immediately under the Sutures, and with the Brain it self, by the intervention of the *Pia Mater*, (to which it is joyned both by the intervention of large Blood-vessels, propagated thence to the longitudinal

and lateral *Sinus's*, and certain carnous Adnaſcencies, as it deſcends down betwixt the two Hemiſpheres of the *Brain*, and afterwards at its approach to the back of the *Corpus Calloſum*, (over which that Membrane is looſely expanded) both by continuity of its Membranous Subſtance and Ramifications of *Blood-veſſels*, terminating in the fifth *Sinus*, at the bottom of the Proceſs, ſo that in a *Diſeaſed Brain* I once ſaw it drawn up the length of an Inch from the ſaid *Corpus Calloſum*, in the exact form of a membranous thin Production, continued to the fifth *Sinus* running at the bottom of this Proceſs,) it keeps the *Brain* ſuſpended in ſuch a natural conformation, that it needs not, to that internal part by the Ancients call'd *Fornix*, nor that by *Vieuſſenius* of late ſubſtituted in the room of it, call'd *Corpus Calloſum*, for its ſupport.

Another Uſe it hath is, partly to defend the *Cerebellum* from Compreſſion, to which, by its connexion with the *Galli Criſta*, it doth not a little contribute, but chiefly the two Hemiſpheres of the Brain from the like Injury from each other, upon its various poſition in Sleep or otherwiſe; and

and therefore is wanting in many other Creatures, as Calves, Sheep, &c. which not only Sleep leſs, but for the moſt part in a leſs injurious poſture.

The Second Proceſs of the Dura Mater.

The ſecond is that which ariſing ſo forwardly as from the hindermoſt Proceſs of the Wedglike Bone, which compoſes the back and uppermoſt part only of the *Sella Equina*; it paſſes up betwixt the *Cerebrum* and *Cerebellum*, all the way adhering to the internal Eminencies of the *Oſſa Petroſa* to the lateral *Sinus's*, by which means not only the *Cerebellum* immediately, as is commonly obſerved, but conſequently all the Parts from the beginning of the fourth *Sinus*, or the *Glandula Pinealis*, to the laſt *Foramen* of the *Skull*, (*viz.*) the *Caudex Medullaris*, with its Appendices the *Nates* and *Teſtes*, (which being placed upon the upper part of the *Medulla Oblongata*, make a ſort of an *Iſthmus* betwixt the *Cerebrum* and *Cerebellum*) together with the Nerves proceeding out of it, are defended from the injurious preſſure of the hinder Limbs of the Brain.

CHAP.

CHAP. II.

Of the Pia Mater.

THE Second Integument of the Brain, commonly called *Pia* or *Tenuis Mater*, by *Galen* and many others, *Choroeides*, from its likeneſs in ſubſtance and ramification of Blood-veſſels to that Membrane of the Secondines call'd *Chorion*, with much more reaſon than *Veſalius*, on behalf of the *Plexus Choroeides* it ſelf advances againſt it; was by all the Ancients look'd upon as its only other Integument, being a very thin and pellucid Membrane, co-extended with the Brain it ſelf, not only in its outward but inward ſtructure too, as likewiſe through all its Plicatures, Interſtices, and Cavities, even over the *Corpus Calloſum* it ſelf, tho' looſely, as hath been already obſerv'd, notwithſtanding the great *Veſalius* affirms the contrary: Which Membrane alſo a chance cut in pareing the top-part of the Brain down to the lateral Ventricles with a Razor, in a *Body* I lately had, gave me an opportunity of *Veſal.* p. 778. par. 2.

of ſhowing as fair in thoſe Ventricles as the largeſt Membrane of the whole Body, to ſeveral who ſtood by, notwithſtanding *Molinetti*, who laughs at all that pretend to have found any ſuch thing, affirms the contrary. *Mol.* p. 78.

But this is to be enquir'd for either in recent Bodies, or ſuch who have before death been, thro' ſome Diſeaſes, fill'd with extravaſated *Serum*, as *Dropſies*, *Stoppage of Urine*, ſome ſort of *Apoplexies*, or the like: That way which in want of the other opportunities diſcovers it beſt, is the ſeparating the *Septum Lucidum* near to its riſe, which is juſt from the *Fornix*, where it ariſes from its two Roots, near to which place the *Medulla* of the Brain begins to advance into the *Corpora Striata*; for from thence for above half way of its paſſage backward toward the hinder limbs of the Brain, it continues hollow, and, I am apt to think, is but a Duplicature of this part, tho' it may be ſomewhat medullary, and therefore, by reaſon of its tranſparency, hath the Name of *Septum Lucidum*.

This Opinion of the Ancients, of its being the only other, and that a ſingle Integument of the Brain, was equally

equally receiv'd for Truth by the late two learned and curious Anatomists *Willis* and *Vieuſſenius*, together with all the other modern Writers, except *Bidloo* and *Bohn*, both which affirm, they have found another diſtinct membranous Integument of the Brain coming betwixt the other outward *Dura*, and inward *Pia Mater*, the one three hours, the other fifteen days after death; and by them both reckoned the original of the ſecond proper Integument of the Spinal Marrow which *Tulpius* firſt diſcovered, and *Vieuſſenius* ſuppoſes to be a Duplicature of the *Pia Mater* in that part only.

Bid. Tab. 8 f. 5, 8. *Bohn* p. 333

Tulp. cent. 1 obſ. 29. *Vieuſſen.* p. 143. par. 2.

Now, that there was a middle Membrane in ſome parts of the Brain, and particularly at the Baſis of the *Cerebellum*, from whence it's continued down to the Spinal Marrow, conſtituting the ſecond proper Integument of that part as afore-mentioned, I had long ſince obſerved; but whether it be another abſolute diſtinct Membrane from that other ſubjacent one, by the aforeſaid Authors properly named the *Pia Mater*, and common to the Spinal Marrow with the Brain it ſelf, like as is this other ſe-

ſecond middle one too, or only one and the ſame Membrane double, as conſiſting of two *Lamina's*, may well be doubted of.

Wherefore, for ſatisfaction concerning this difficulty, I have lately made the ſtricteſt enquiry poſſible, and that in a ſubject moſt likely to afford a deciſion in ſuch a Controverſie, and this was an Human Brain extreamly hydropical, where there was no Cavity or Interſtice, without abundance of Water extravaſated, inſomuch that where ever, according to the natural conſtruction of Parts, there was any larger than ordinary duplicature of this Membrane, as there are at the end of the *Calamus Scriptorius*, betwixt the ſuperincumbent *Cerebellum* and *Medulla Spinalis*, in the *Iſthmus* or ſpace betwixt the *Cerebrum* and *Cerebellum*, upon the Proceſſes called *Nates* and *Teſtes*, in the depreſſed part alſo of the Brain, between the beginning of the Annular Proceſs, and the firſt appearance or coming out of the Olfactory Nerves, by *Veſalius* taken notice of and called a *Proceſs of the Pia Mater*, there was found a great deal of Water diſtending this Duplicature much beyond its natural limits; *Veſal.* p. 794

mits; ſo that by way of conſequence, if theſe Cavities were only Interſtices of two different Membranes diſtinctly inveſting the Brain, and not a Duplicature only of one and the ſame, the Water would then probably have inſinuated it ſelf betwixt them, and made them to have appear'd far different from what they did, agreeable to what it hath often been found to do in ſome *Dropſies of the Belly*, where the Water hath been found ſo to have divided or parted the double Membrane of that Region call'd *Peritoneum*, as to have render'd it capable of containing the quantity of fifteen Gallons of Water, and upon a diſcharge of the ſame after death, by cutting the external *Lamina* of that Membrane, the other inward one being yet (unknown to the Diſſecter) left whole, to have impoſed upon the Spectators, and thoſe very ſagacious ones, ſo as that at firſt ſight, till after having recollected themſelves, and divided the other ſecond *Lamina* too, they thought the Bowels of this part to have been wanting; but contrary to this Event, in this Subject I found this Membrane entire, and free from any divulſion throughout its whole cir-

Job Meyer. Obſ. 52.

circumference, excepting the places afore taken notice of. However, ſuppoſing the like conformation here in this with the Membranes of the other parts, I attempted to divide it, and did ſo ſucceſsfully in many parts of it, but moſt readily in the beginning of the ſuperficial Plicatures of the cortical part of the Brain, where there are naturally ſmall Interſtices, betwixt which many of the Blood-veſſels creep into and immerge themſelves in the cortical and medullary parts thereof: So that I think there cannot remain any further ſcruple of its being only a double, and not two diſtinct Membranes of the Brain.

Bidloo very truly obſerves this firſt or middle Membrane, by him ſo called, by me only the firſt, or one *Lamina* of a double Membrane, to be thinner than the *Dura Mater* above it, and thicker than the other Membrane or *Lamina* under it; which laſt moſt properly it is that inſinuates it ſelf through all the cloſe Plicatures of the Brain, and that, as by frequent inſpection I have often obſerved, not in a continuous, but rather retiform contexture, and ſo, by ſuch as love hard words, or terms of Art, may be call'd

called after the ſame name of that Membrane inveſting the cryſtalline Humour of the Eye, *Arachnoeides*.

The Advantages accrueing to the whole through ſuch a diſpoſition of this part, as hath already been obſerved, are very conſiderable, inaſmuch as that thereby firſt of all it becomes not only an Integument of incloſure, on behalf of the Brain, and the Blood-veſſels belonging to it in general, but of expanſion for Strength too, where the peculiar ſtructure of Parts, in ſuch places as were before mentioned, require it.

As to the firſt, the Brain is not only kept more warm, cloſe, and compact, and better defended on its depending part from the aſperity of the Bone it lies upon, but the Veſſels hereby more ſtrongly ſupported, and it ſelf ſecured from being broken or torn, whilſt between its duplicature they climb up into the Brain, whoſe delicate tender Fibres muſt otherwiſe of neceſſity have ſuffer'd violence by the largeneſs and pulſation of the Arteries, together with the weight of them, and the other reductory Veſſels, from which the *Sinus's* meet them.

Nextly,

Nextly, as it is an Integument of Expanſion in the places before mention'd, that tender ſmall part the *Infundibulum*, where it quits the Brain, in order to its paſſage into the *Glandula Pituitaria*, by the circumtenſion of this outward *Lamina*, is fortified upon any violent Accident from diſruption, and the Brain and *Medulla Oblongata*, in thoſe places where they are only looſely contiguous, are better preſerved in their natural due connexion; all which Advantages, inaſmuch as they may more reaſonably be aſcribed to one double Membrane than two ſingle ones, tho' of the like ſtrength when joyned faſt together, may not unreaſonably be thought to argue for the duplicature of this Membrane excluſively, to the introduction of a third or new one.

Laſtly, as to what concerns the *Glandes* and *Plexus's*, which Dr. *Willis* affirms to be ſcatter'd all over this Membrane; as to the former, I could never ſee them, but I have ſeen the external Superficies of the cortical part of the Brain, in ſtrangled Bodies, appear glandulous very plainly, through this tranſparent Integument, which upon bare inſpection, *Will.* p. 26. col. 1.

C with-

without further enquiry, might eaſily impoſe upon the leſs cautious Spectator.

As to the latter, the *Plexus's*, and diſtribution of Blood-veſſels from them, after a ſeparation of the ſerous groſs part of the Blood in the aforementioned ſuppoſed *Glandules*, (according to that learned perſon's conjecture) into the ſubſtance of the Brain, in order to produce the finer Animal Spirits; I cannot but look upon it altogether conjectural, till ſuch time as not only the *Glandes*, but their excretory Ducts alſo, together with the Emunctories where the ſuppoſed excrementitious Juice is eliminated, (lymphatick or reductory *Glandes* (if they could be found) never having been by Nature deſigned to any ſuch uſe) be firſt diſcovered.

Blood-veſſels of the Pia Mater.

This Membrane hath Blood-veſſels of two ſorts.

Of the firſt are theſe properly belonging to the Brain it ſelf, which, as it hath already been obſerv'd, it doth as it were conduct through its Duplicature, in their paſſage allowing them thereby the opportunity of growing extreamly fine, after many ſerpentine twinings towards their capillary Extremities,

tremities, before they are protended into the Brain it ſelf, and thoſe are chiefly ſpread all-along upon the under or ſecond *Lamina* of this Membrane. *Bid.* Tab. 8. f. 5. l. M. Ib. l. G.

The ſecond are thoſe which belong to this part it ſelf, for its own nouriſhment, and theſe I found upon diligent inſpection, whilſt I ſeparated its ſecond *Lamina* ſpread plentifully upon the inſide of the outermoſt or firſt *Lamina*, and both theſe you will find very well delineated in the places quoted in *Bidloo*.

This Duplicature is alſo very plainly communicated to all the Nerves both within and without the *Cranium*, making by its outward *Lamina* a ſecond Integument under the firſt from the *Dura Mater* to the whole *Faſciculus* of Nerves, and a third by its inward *Lamina*, which yields an *involucrum* or covering to each ſingle *Fibrilla*, which collectively make up the whole Nervous Body it ſelf, thro' the admirable fineneſs of which Membrane inveſting thoſe medullary Fibrils, altogether inſenſible of themſelves, it happens there is ſuch a nimble conſent betwixt part and part, and betwixt all and the Brain it ſelf.

CHAP. III.

Of the Veſſels belonging to the Brain *in general.*

THE Veſſels belonging to this part in common with the reſt of the Body, though in reality but one continued Canal variouſly modified, yet, through the diverſity of Fluids they contain, go commonly under the denomination of *Arteries*, *Veins*, *Sinus's*, and *Lymphæducts*, and not without good reaſon, perhaps, the *Nerves* may be in ſome ſence of the ſame kind too.

The two firſt of theſe may, with relation to their different diſtribution, be deſervedly conſider'd in a two-fold reſpect, either as they belong to the firſt Integument of the Brain, or the Brain, properly ſo called, it ſelf.

The Arteries therefore belonging to this part called *Dura Mater*, or *firſt Integument*, are three fair Branches on each ſide.

The

The firſt and foremoſt of which are ſent out from the Carotid Artery, whilſt it remains in the fourth
Fig. 2. hh. hole of the *Cranium*, and are propagated chiefly through the foremoſt part of the bottom of the *Dura Mater*, as in the Figure delineated, but greatly miſtaken by Dr. *Willis*, perhaps taking it upon truſt from *Wepfer*, equally with himſelf therein miſtaken; who deſcribes it for a ſmall branch of the Carotid Artery, that runs betwixt the two firſt Lobes of the Brain, which inſtead of coming out of the Bone of the Forehead, as he would have it, goes into it without lending any branches to this Membrane at all, being truly delineated and deſcribed by the aforemention'd accurate *Vieuſſenius*.

Willis p. 2. col. 2. *Wepf.* p. 105 par. 2.

Vieuſſ. Tab. 17. dd, bb. p. 32. par. 4.

And that this Artery was not only miſtaken by, but unknown to the aforeſaid *Wepfer*, is plain, ſeeing he ſays, that from the very ſtyliform Proceſs, where the Carotid Artery does indeed enter the long Canal, to the place where it perforates the *Dura Mater* to enter the Brain, there is not one Branch ſent out from it; which Error, by injecting with Wax, which keeps longer in,

Wipf. p. 101

and ſhews the Veſſels much better than ſmall tinged Liquors, had very eaſily been avoided.

Fig. 2. ii. The ſecond Branch of Arteries aſcend into the *Dura Mater* by the ſixth hole of the *Cranium*, together with a Branch of the internal Jugular Vein, and are diſperſed laterally all over the fore-part of this Membrane, as far as the very *Sinus Longitudinalis*, (which nevertheleſs it enters not, as there will be occaſion to take notice of hereafter) as in the Figure delineated.

The third Branch of Arteries climb into the *Dura Mater* by the eighth hole of the *Calvaria*, together with a ſmall reductory Branch of the Vertebral Vein, where the

Fig. 2. kk. lateral *Sinus's* enter the internal Jugular (which occaſion'd the Ingenious *Highmore* erroneouſly to believe it enter'd the very lateral *Sinus* it ſelf) and the eighth pair of Nerves paſs out of the *Cranium*, which paſſage of this Artery is not hitherto deſcribed by any that I know of; neither have I ever ſeen it figured, but in *Vieuſſenius*'s firſt Cut, and there but very faintly.

Highmore, p. 206. par. 1.

Vieuſſ. tab. I kk.

It

It arises from the external Branches of the Vertebral Artery, according to *Vieussenius*, but *Bartholine* makes it to be a slip of the Carotid Artery, calling it the lesser Branch thereof; wherein he is mistaken. *Vieuss.* tab. 8. f. 1. c. *Barthol.* p. 431. par. ult.

The Veins of the Dura Mater.

As to the Veins, *Riolane*, and after him *Willis*, seems to say this Membrane hath none; for tho' the latter hath this obscure expression of them, *Tam crebris Venarum propaginibus quam Arteriarum nusquam consita est*; speaking of the *Crassa Meninx*, by which we might guess he thought it had some, yet in another place he plainly substitutes the *Sinus's* for the reductory Vessels, as well on behalf of this Membrane as the Brain it self; as appears plain enough in the Page noted. *Riol.* p. 252 par. 2. *Will.* p. 2. col. 2. par. 6. *Will.* p. 22. col. 1. par. 4.

Vieussenius indeed allows Veins to this part, and says, they all-along accompany the Arteries, and afterward terminate, according to *Veslingus*, in the internal Jugular; yet in another place he says, some of the Venal Branches discharge the Blood into the *Sinus Longitudinalis*. Which last is a flat contradiction to the place foregoing, inasmuch as in that he says, they accompany the Arteries *Vieuss.* p. 31 par. 3. *Vesling.* p. 210. *Vieuss.* p. 4. par. 2.

all-along after the ſame manner of diſtribution or ramification; which, if ſo, who ſees not that they muſt needs grow capillary towards the *Sinus*, and conſequently be uncapable of reducing the Blood into them, all reductory Veſſels being always capillary in the place from which, and not to which, they bring that which they contain.

Now therefore, neither what the one nor the other ſays can poſſibly be true; for, as to the former the learned Dr. *Willis*, if his Aſſertion was good, it muſt of neceſſity follow, that all the Arteries diſperſed thro' this Membrane muſt terminate in ſome of the *Sinus's*, otherwiſe there will want a reductory Veſſel; the firſt of which is contrary to ocular demonſtration, the laſt to common reaſon.

As to *Vieuſſenius* the latter, beſides what hath been already ſaid againſt him, if what he ſays in the place aforecited be true, that the Veins of the *Dura Mater* run concomitantly along with the Arteries, then they muſt of neceſſity anſwer the ends of other Veins throughout the whole Body, in reducing the Blood

Blood adduced by the Arteries, unleſs the Arteries they accompany diſcharge their Blood into the *Sinuſſes*, (which, as hereafter ſhall be ſhown, they plainly do not) for otherwiſe, ſeeing they both grow capillary in their aſcent from the Baſis of the *Cranium*, they muſt neceſſarily be both adductory Veſſels, than which, by the Laws of Circulation, there can be no greater an Abſurdity.

Wepfer not knowing of theſe Veins, was forced to think, and conſequently to affirm, That the Arteries leave the *Dura Mater* in their extremities, and terminate in the *Pia Mater*, and ſo have their Blood reduced by the Veins there; but this is evidently not ſo to the Eye of any who heedfully ſeparates this Membrane from the other.

Before therefore I proceed to the deſcription of the Blood-veſſels belonging to the Brain it ſelf, which by the exactneſs of method I ought to do, I hope it may be pardonable, if I make a ſhort enquiry after the unaccuſtom'd diſtribution of Blood-veſſels Nature hath furniſh'd the Brain in general with, and the Reaſons of its procedure therein.

The

The Truth then concerning this affair, is, That contrary to what hath hitherto been obſerved, the Blood-veſſels belonging to this part in general, as hath already been obſerved, are of two ſorts, the one belonging to the Brain it ſelf, the other to its outmoſt Integuments.

Now, as to the firſt, 'tis obſervable, that the Veins enter not the Brain, nor run concomitantly, like as in other parts of the Body, with the Arteries, (the carotid entring at the fourth hole in the Baſis of the Skull, and the internal Jugular at the eighth; the Vertebral Artery at the laſt and largeſt hole of the Skull, and the Vertebral Vein at the ninth (which *Vieuſſenius* miſtakenly calls the tenth) thro' which it runs into the internal Jugular, at that Veins entrance into the round hole at the bottom of the Skull, under the Styliform Proceſs, where the *Sinus Lateralis* meets it) where after having advanc'd into certain venous productions called *Sinus's*, they deſcend from thence in large Trunks, growing capillary all-along in their paſſage till they meet the Extremities of the Arteries, and are indeed no other than meer

Vieuſſen. p. 163. par. 3.

meer Branches of the *Sinus's*, and conſequently I look upon the *Sinus's* themſelves no other than large Veins.

The common reaſon all modern Authors give for this different diſtribution of Blood-veſſels belonging to the Brain, from the other parts of the Body, is, that it may receive an equal warmth at the top as at the bottom, as being thereby very much aſſiſted in the production of Animal Spirits in an equal proportion all over; and that it is ſo may very well be granted: but, that Nature had yet another provident Intention, will be as evident, if we conſider, that if the Veins had aſcended with the Arteries thro' the holes in the bottom of the *Cranium*, upon all great Ebulitions of the Blood, the pulſation of the Arteries would in that Stricture of the Veſſels made by the Bone, of neceſſity hinder the freedom of its return by the Veins, and conſequently occaſion a ſtagnation of Blood through the whole Brain, to the utter ſubverſion of all its faculties, nothing being more certain, than that upon any conſiderable abatement of circulation there preſently happens by

by way of reſtagnation, a ſeceſſion of the watery and thin from the more groſs and red part of the Blood.

The other way of the Veins entring the Brain (*viz.* thoſe appertaining to its outward Integument, one at the ſixth hole of the Baſis of the *Cranium*, the other at the eighth, as aforeſaid) is, their aſcent with the Arteries after a quite different manner from the former, even to their capillary Extremities; a manifeſt indication that they ſerve for the reduction of ſo much Blood from the *Dura Mater* as the aforeſaid ſort of Veſſels, the Arteries, have brought thither; and although by reaſon of their ſmallneſs Nature ſeems not to have been ſo ſollicitous in avoiding the Inconvenience ſuppoſed to have follow'd, upon the Artery's entring the ſame hole with the Veins, taken notice of in the preceding Caſe, where they are very large, and conſequently the Effect might prove much more injurious, yet Nature hath not been wanting in providing a Remedy againſt it; as will plainly appear in the following Pages.

From

From this manner of their entring the Brain at the ſame inlet of the Skull with the Arteries, may, for ought I know, be very rationally accounted for that violent troubleſome Noiſe which many, in Diſtempers ariſing from the turgeſcency of the Blood, cauſing a preternatural beating of the Arteries, do ſo much complain of; a Symptom happening from the Stricture before mention'd which the unyielding circumference of the Bone occaſions upon the different Blood-veſſels entring at one and the ſame Foramen, to which effect alſo the nearneſs of the *Os Petroſum*, through which the Hearing Nerves do paſs to this hole, which is in that part of the Wedglike Bone that joyns to, or is conterminous with it, does not a little contribute.

To the ſame cauſe, in ſome meaſure doubtleſs, may be aſcribed the frequent Headachs happening in Feavers, the Artery then ſo ſwelling and compreſſing the Vein againſt the edges of the Bone, that the Blood cannot be returned back through it in a due proportion, and conſequently by its ſtagnation the Membrane becomes inflamed and painful.

So

So that conformable to what hath already been taken notice of concerning the wiſe contrivance of Nature, in ordering the different diſtribution of the Blood-veſſels, ſo as to avoid the Inconveniencies which might accrew to the Brain by compreſſion of the reductory Veſſels, occaſion'd through their entrance at one and the ſame hole with the Arteries; it ſeems very much worth our obſerving, that beſides the Veins of the *Dura Mater*, which enter the *Cranium* together with the Arteries, as hath before been mention'd, there are alſo ſeveral others belonging to this Membrane, having their riſe at, and their deſcent after a very remarkable manner, from a Vein hereafter to be deſcrib'd on each ſide of the Longitudinal *Sinus*, as you may ſee in the Figure, and conſequently muſt grow capillary in their deſcent down from it, after a quite contrary manner to the other; and theſe do viſibly inoſculate with ſome of the Extremities of the aforeſaid capillary Arteries, after the ſame manner as thoſe larger Veins belonging to the *Pia Mater* do with the Arteries be-

Fig. 4. dd,nn,&c.

belonging to the Brain and it, by which means it ſo falls out, that a conſiderable part of that Blood brought up by the *Meninx Arteries*, is carried back by theſe Veins, to the end that, eſpecially in all preternatural ſwelling of the Blood, the inconvenience of Compreſſion and all its ill conſequences happening, by reaſon of an overfulneſs of theſe Veſſels, may be in a great meaſure avoided.

CHAP.

CHAP. IV.

Of the Veins belonging to the Brain *it ſelf.*

AFTER this ſhort digreſſion, by order of Method, the Blood-veſſels belonging properly to the Brain it ſelf, fall under conſideration.

The curious Anatomiſt *Malpighius*, in his Letter to *Fracaſſatus*, ſays, they bear a third proportion to thoſe of the whole Body; and for what reaſon, ſeeing the part it ſelf bears not the ſame proportion to the whole, it is ſo, it will be worth our while to enquire hereafter. *Malp. de Cereb.* p. 6. par. 2. *De Cort. Cereb.* p 81 par. 2.

Theſe are either Arteries or Veins. The former go under the name of *Carotid* and *Vertebral.*

The firſt of which, after a curved paſſage (which is very well expreſſed in a Fig. of Dr *Willis*) from the place where it begins to enter the Baſis of the *Cranium* (which is from the Styliform Proceſs of the *Os Petroſum*) to the place where, on the inſide, they paſs through the *Dura Mater*, and aſcend into the Brain, (which is at the fore- *Willis* p. 29. Fig. 1.

foremoſt internal Proceſs of the *Os Cuneiforme*) there is very near an inch and an half diſtance. I ſay, after this crooked paſſage into the Brain, they are propagated quite through its ſubſtance, having firſt diveſted themſelves of that thick Coat borrowed of the *Dura Mater* during their ſtay in the paſſage aforementioned; but not without the mediation or intervention of the *Pia Mater*, which Membrane all the Branches of the aforeſaid, as well as the Vertebral Artery, more or leſs firſt prop themſelves upon, before they enter on and diſperſe themſelves through the ſubſtance of the Brain it ſelf, and is very finely expreſſed in a Cut of *Placentinus*, at the end of *Spigelius*; inſomuch that *Molinetti* (with whom alſo agrees *Marchetti*) looks upon it as only a production of thoſe numerous Veſſels; whereas all thoſe little ramifications both of the Carotid and Vertebral Arteries, *viz.* thoſe from the carotid Artery, which as ſoon as it gets through the *Dura Mater*, and parts with its borrowed Coat, are ſent to the [a] *Infundibulum*, [b] *Olfactory*, and [c] *Optick Nerves*, together with thoſe other of the Vertebral Artery which accom-

Spig. p. 179 *Mol.* p. 77. *Marchetti*, p. 191. par. 5.

[a] *Vieuſſen.* p. 35. par. 1.
[b] p. 34 par. 6. Tab. 17.
[c] *Ib.* § 8.

pany the [d] third, [e] fourth, [f] fifth, [g] sixth, [h] seventh, [i] eighth, [k] ninth, and [l] tenth pairs of Nerves, inasmuch as they enter not the Brain it self, are altogether exempt from that Membrane; any of which now-mention'd Blood-vessels you either find delineated in *Vieussenius*'s 17th Table, or mention'd in some other place of his Book, by those Directions here placed in the margin; all which, tho' existent in Nature, are nevertheless there painted too stiff and formal (I am afraid by guess) inasmuch as that without an injection of Mercury (except those two which belong to the *Olfactory* and *Optick Nerves*) they do rarely come to sight in any form at all, Wax being over gross a body to enter such minute Vessels as those are; whereas by an injection with Mercury I find scarce any Nerves but what hath some such small ramifications of Blood-vessels in them.

[d] *Vieuss.* P. 35. par. 1.
[e] Ibid.
[f] Tab. 17. p. 35. par. 1.
[g] Tab. 17. TT. Tab. 4. h h. p. 35. par. 1.
[h] Tab. 4. hh.
[i] Tab. 17. Fig. 2. Tab. 4. h h.
[k] *Ib.* Fig. 2.
[l] Tab. 4. h h.

To go about to describe distinctly the whole ramification of Arteries through this part, which as was before noted, is here more remarkable for number and size than in any other part of the Body, would not only be to do what in a great measure hath been

been already done by *Vieuſſenius*, in his ſixth Chapter, but ſeem to have alſo in it much more of oſtentation than uſe.

I ſhall therefore only take notice of ſuch propagations of them, as are either remarkable for magnitude, ſome curioſity of Structure, or uſeful deſign of Nature.

And of this ſort may well be eſteemed the Vertebral Artery, next after the Carotid, which hath already been deſcribed, as entering the Brain at the laſt and largeſt Foramen of the Skull, contrary to what Dr. *Willis*, and before him *Wepfer*, affirms, coming thither on each ſide out of the hole in the tranſverſe Proceſs of the firſt *Vertebra* of the Neck, after a very remarkable curved manner, as you ſee in the Figure, (and by no means like to the delineation and deſcription given by Dr. *Lower* and Dr. *Willis*,) aſcending laterally upon the *Medulla Oblongata* as far as the beginning of the *Proceſſus Annularis*, where they meet together in one ſingle Trunk continuing ſo the length thereof, by *Vieuſſenius* call'd *Arteria Cervicalis*, after which they either ſend forth two Branches, or receive two from the carotid Artery, by

Willis, p. 29. col. 1. par. 2. Par. 1. Ibid. *Wepf.* p. 112. *Low.* Tab. 4. Fig. 1. E E

Vieuſſen. Tab. 4. bb.

means whereof there is a communication betwixt theſe two large Blood-veſſels, and that of great uſe and benefit to the Brain, for by this means it happens, that if even three of the four great *Arteries* which furniſh this part with Blood, were totally obſtructed, there would yet be a way left for a competent ſupply from the other unobſtructed fourth. Theſe I call the *Communicant branches*, very ill painted in *Bidloo*'s ninth Table, but very well in *Vieuſſenius*'s fourth; as may plainly appear here in the Figure taken exactly from Nature it ſelf. *Vieuſſen.* tab. 4. b b. FIG. 1. dd

The ſtructure and ſmallneſs of theſe Arteries ſeem to ſuggeſt two, yet further, provident Intentions of Nature.

The firſt is the ſame it hath expreſſed in ſeveral other places, as in the aſcent of the Blood by the Carotid Arteries, both which enter the Brain in a crooked line, the firſt at the fourth hole of the Baſis of the Skull, the ſecond from the hole in the tranſverſe proceſs of the firſt *Vertebra* of the Neck, after the manner already in both places deſcribed. So in the like manner here, by the narrowneſs of theſe Branches, the Blood is in a great meaſure retarded in its motion

motion to the carotid Artery, and by conſequence to the Brain it ſelf, which, for Reaſons hereafter to be given in deſcribing the *Sinus's*, would otherwiſe be in great danger of being overflowed with extravaſated and reſtagnant Blood.

The ſecond is, a forcing the Blood more plentifully into the Spinal Artery, with which, tho' through the conical ſtructure of the Arteries in common it cannot be altogether unfurniſh'd, yet by its perfectly-reflexed poſition, would have it very ſcantily, were it not that by reaſon of the narrowneſs of the aforeſaid *Communicant-branches* betwixt the two great Arteries, the Blood was driven back in a ſort of a retrograde motion.

'Tis true, there is a conformation of Arteries ſomething like this, tho' not altogether in the mammary and epigaſtrick Branches; but 'tis worth noting, that in both theſe places the main Artery from which theſe Branches ſpring is much more taper or conical, and the ſucceeding exporting Veſſels far leſs both in number and ſize than thoſe of the carotid Artery here, whoſe foremoſt and hinder lateral ramifications between the *Ibid.* p. c c

Lobes of the Brain, bear an over-proportion to the Trunks from whence they come, and consequently must, according to the aforesaid observation of *Malpighius*, in his Letter to *Fracassatus*, receive the blood brought thither far more freely and plentifully.

Besides, the Cervical Artery here is so far from being Conical, that being made up of two vertebral Arteries joyning together, it is much wider than either of them single, as appears plainly in the Figure, and consequently would have carried away the Blood forwardly from the Spinal Artery more freely, had not Nature order'd the Structure of Vessels after another manner here than it does in other parts of the Body, where there is not the same necessity of contrivance.

FIG. 1. g.

One more Branch I take leave to mention only upon the score of its never hitherto having been taken notice of by any, and that's a small Artery attended with a Vein passing through the lateral part of the *Os Cuneiforme*, (which constitutes the back part of the *Orbite of the Eye*, just under a very little Process of that Bone, (which either by reason of its size

ſize hath eſcaped being ſeen, or inconſiderable uſe, was never before, as far as I know, thought worth the mentioning;) and this, upon raiſing the fore Lobes of the Brain, offers it ſelf to the Eye of any heedful Obſerver.

CHAP. V.

Of the Sinus's *belonging to the* Brain.

A Third ſort of Veſſels offer themſelves next to our conſideration, under the general name of *Sinus's*.

Theſe formerly were reckon'd only four, to which *Veſalius* added a fifth at the bottom of the *Falx*, by him only call'd a *Vein*, which tho' frequently found, yet in ſome Subjects is wanting. *Bourdon* mentions two more at the bottom of each ſide the ſecond Proceſs of the *Dura Mater*, *Veſal.* p. 758 Fig. 3. F. *Bourd.* p. 195. par. 2.

under the lateral ones, which I never ſaw but once, and I am apt to think with *Vieuſſenius*, are moſt commonly wanting.

Vieuſſenius deſcribes four more, which I find long before taken notice of, and exactly deſcrib'd by *Falloppius*, and after him, tho' but rudely, by that laborious Collector *Vidus Vidius*. *Vieuſſ.* p. 6. par. 5. *Fall.* tom. 1. p. 114. *Vid. Vid.* p. 117. cap. 10. p. 310. cap. 11.

I think I can ſhew one more, but be their number what it will, I judge it reaſonable to look upon them no other than Veins, whether we conſider them in reſpect to either Office or Structure. All the buſineſs is, to conſider and ſhew for what end they appear as ſuch large Channels into which all the Veins of the Brain, like ſo many ſmall Rivulets after an unuſual manner do empty themſelves; and that I will endeavour to do after having firſt ſhown their ſeveral reſpective ſituations.

The firſt two are called *Laterales*, which run within a ſtrong duplicature of the hinder Proceſs of the *Dura Mater*, down upon the *Os Occipitale* over the *Cerebellum*, till in their further deſcent, after a tortuous manner, upon the lower production of the *Oſſa Petroſa* Fig. 4. BB.

Fig. 2. GC. *troſa* they wind under them in order to their paſſage out of the *Cranium* at the eighth hole, common to the eighth pair of Nerves going out, the third Branch of Arteries belonging to the *Dura Mater*, and the internal Jugular coming in, which is through two round bony Cells in the *Os Petroſa*, juſt under the Styloeid Proceſſes into the internal Jugular Vein, into which, together with the Vertebral, all the reſt of the Veins and *Sinus's* belonging to the Brain diſcharge the refluent Blood.

Ibid. b b.

Ibid. L.

Fig. 4. AA, &c. The next is called the third or longitudinal one, from its riſe at the bony Proceſs called *Criſta Galli*, and progreſs the whole length of the Brain to the hinder and ſomewhat declining part of the occipital Bone, where it ſeems to be cleft into the two lateral ones.

Into this third *Sinus* not only the internal Veins of the Brain it ſelf are inſerted, but alſo ſome of thoſe belonging to its outward Integuments, which *Falloppius* firſt, one of the Luminaries of Anatomy, obſerved; and after him *Vieuſſenius*, which are by *Wepfer* miſtakenly taken for Arteries, who nevertheleſs, for ought I know, may

Fallop. tom. 1. p. 82. par. 3
Vieuſ. p. 19. par. 2.
Wepf. p 42. par 2..

may be in the right, in assigning the overcloseness of the Pores of the *Cranium* (by what Accident soever happening) thro' which the refluent Blood is transmitted to the *Sinus*, for a frequent cause of inveterate obstinate Headachs.

Fig. 4. C. The fourth, which from its situation may not improperly be called the *Internal Sinus*, comes from the under part of the falcated Process, at that point where it becomes continuous to the second Process of the

Ibid. II. *Dura Mater*, and a large double Vein belonging to the *Plexus Choroeides*,

Ibid. K. together with the fifth *Sinus*, (when there is one) enters it at an Interstice made between the end of the *Corpus Callosum*, the *Nates*, *Testes* and *Cerebellum*, from whence having first passed over the *Cerebellum*, it at last arrives with the other three at that place of union, which from its Author hath ever since retain'd the Name of *Torcular Herophili*.

Ibid. g.

The four others of *Falloppius* and *Vidus Vidius*, or *Vieussenius*, by this last called *Superiores* and *Inferiores*,

Fig. 2 dd. the dd first two of which being longer and narrower, are call'd *Superiores*, are on the Basis of the Brain *, arise,

ac-

according to him, from the *Receptacula Sellæ Æquinæ*, by the ſame Author ſo named, (hereafter to be deſcribed, though more truly, from the ee circular *Sinus*, as I hope in its place to make appear, running down from thence upon the internal Proceſs of the *Os Petroſum*, and terminating in the *Sinus Laterales*, where they begin to be declive and λ tortuous in their paſſage to the internal Jugular.

Ibid. EE

Ibid. λ.

The other two, called ee *Inferiores*, which are much ſhorter and wider than the others, deſcend from the ſame place as the former, between the *Os Petroſum* and *Occipitale*, down to the aforeſaid eighth hole of the *Cranium*, where the Jugulars come up into the Brain, and end there.

Ibid. ee.

Another I diſcover'd by having firſt injected the Veins with Wax running round the *Pituitary Gland* on its upper ſide forwardly within a duplicature of the *Dura Mater*, backwardly between the *Dura Mater* and *Pia Mater*, there ſomewhat looſely ſtretched over the ſubjacent Gland it ſelf, and laterally in a ſort of a Canal made up of the *Dura Mater* above, and the carotid Artery on each outſide of the Gland, which by being faſten'd

faſten'd to the *Dura Mater* above, and below at the Baſis of the Skull too, leaves only a little Interſtice betwixt it ſelf and the Gland, thereby conſtituting a Cavity communicating with the two forementiond forward and backward ones, from whence the abovementiond four ſmall *Sinus's* do deſcend, by a viſible continuity, on each ſide from a little beneath the hinder Proceſs of the *Sella Turcica*: and this from its Figure may not unfitly be called the *Circular Sinus*. FIG. 2. EE

Vieuſſenius, it may be, ſaw ſome part of this *Sinus* where the other four ſmall ones enter it, which is at the hindermoſt part of his *Receptacula Sellæ Equinæ lateribus adjacentia*, ſo called, and from thence thought thoſe Receptacles to communicate with and to be capable of performing the office he aſſigns them, (*viz.*) of bringing back Blood from the nouriſhment of the ſubjacent Bone call'd *Cuneiforme*, together with the Water ſeparated ſtom the Pituitary Gland, into theſe four inferiour *Sinus's*.

Now, as concerning theſe Receptacles of his, 'tis certain that they are not any where exiſtent in Human Brains, (according to the deſcription he

he gives of them in the place here noted) ſeeing both the third, fourth, two foremoſt Branches of the fifth, as well as its third hindermoſt one, together with the ſixth pair of Nerves, do not only run out of the Brain encloſed in ſo many diſtinct little *Capſula's* or Coverings made of the *Dura Mater*, during their paſſage through that part of the Baſis of the *Cranium* by him call'd *Receptacula*, &c. but even the whole *Dura Mater*, together with its Membranous Productions conſtituting the aforeſaid Coverings of thoſe Nerves, in that place ſticks cloſe to the Baſis of the ſubjacent Bone, (*viz.*) the External Proceſs of the *Os Cuneiforme*, on its under ſide, and to the Carotid Artery (which alſo both above and below (as was before noted) by its borrow'd coat ſticks cloſe to the *Dura Mater*,) on that ſide towards the aforeſaid Gland, leaving no room at all for either Blood or *Serum* to be contain'd there, as he would have it; tho' in the ſame place which he deſcribes for his Receptacles I have in ſeveral injected Bodies obſerv'd two very fair and large Veins, one coming into the *Cranium* at the ſecond *Foramen* from the

Pag. 16.

the Orbit of the Eye, (and poſſibly may be a Reductory Veſſel to that part) and ſo climbs up on the ſide of the lateral Proceſs of the Wedglike Bone, almoſt up to the *Circular Sinus*; the other at the fifth *Foramen*, which climbs up upon the ſame Bone till it meet and joyns with the other, from whence they make one ſhort Branch, which enters the *Circular Sinus* very near the place where the two other inferiour ones on each ſide deſcend down from it; which if they ſhould chance to be cut by accident in any enquiry made into that part, might cauſe an appearance of Blood, and thereby become an occaſion of the aforeſaid erroneous Hypotheſis.

Neither is it poſſible (granting there were any ſuch Receptacles as he mentions) they ſhould ſerve to the end he aſſigns, ſeeing the *Glandula Pituitaria* is on all ſides encloſed by both the *Dura* and *Pia Mater*; which firſt (notwithſtanding what he ſays to the contrary) is on all ſides of this Gland of a very ſtrong and equal thickneſs; yea, in that very part where (as hath been before taken notice of) there is a kind of a Chaſe made by a certain duplicature *Vieuſſ.* p. 55

of

of the *Dura Mater*, conſtituting the foremoſt part of the *Circular Sinus.*

And if this alſo was granted, yet would the manner he deſcribes of the *Serum* or Water getting into theſe Receptacles (which is by tranſcolation) render his Suppoſition very unprobable, ſeeing 'tis by no means conformable to the Cuſtom of Nature in all other parts of the Body that Arteries ſhould depoſe a *Serum*, or any thing elſe but Blood, (except what goes for Nouriſhment to the Part it ſelf) in any Part, without being furniſh'd either with its Excretory or Secretory Ductus, neither of which was ever pretended to have been found here.

And as a thorow confirmation of all this, ſaid in oppoſition to the aforeſaid Hypotheſis, I ſhall only add this, and conclude, that in ſeveral Injections made uſe of in order to find out the uſe of Parts, I never found one drop of the tinged Liquors on that ſide of the Carotid Artery, where he hath made the ſituation of theſe Receptacles.

The uſe of this *Circular Sinus* is in common with the reſt to reduce Blood returning from all the adjacent parts, as the Pituitary Gland, the Wedg-

Wedglike Bone alſo, and it may be from the *Rete Mirabile*, which in Brutes is very large, and therefore ſeems to require the Service of this *Sinus*, either mediately or immediately, for reducing a ſhare of its Blood, ſeeing the *Glandula Pituitaria* appears no where furniſh'd with Veins terminating any where elſe ſufficient to carry off the refluent Blood from this *Plexus*, notwithſtanding *Vieuſſenius* ſaith on the contrary it hath no Veins, and therefore is forc'd to have recourſe to thoſe ſmall Branches of Veins which accompany the Branches ſent out by the carotid Artery, before it perforate the *Dura Mater*, with the Optick Nerves, or thoſe which go to the *Gangliforme Plexus* of the fifth Nerve, or thoſe coming out of the Wedglike Bone, for reductory Veſſels to this Part; but with what probability I know not.

CHAP

CHAP. VI.

Of the Motion of the Brain *and* Sinus's.

TO theſe *Sinus's*, eſpecially the *Longitudinalis*, and by way of conſequence to the *Lateralis* alſo, moſt if not all the Ancients, as well as Moderns too, particularly *Willis* and *Vieuſſenius*, have unanimouſly aſcrib'd Pulſation, after the manner of Arteries, by reaſon of ſome Arteries (as they thought) from the *Dura Mater* terminating in them: of the truth whereof being ſomewhat doubtful, I reſolv'd to make uſe of ſuch an Experiment as might remove all future Scruples, and moſt ſatisfactorily put an end to the Controverſie; which was as follows. *Vieuſſen.* p. 14. par. 3.

I took off the upper part of the Skull of a Dog alive, by which means the *Dura Mater* with its third *Longitudinal Sinus* lay bare to the Eye and Touch, to neither of which Senſes, at firſt, either any beating of

the Membrane in general, or of the *Sinus*, was the leaſt diſcernable. After ſome pauſe, by chance the *Sinus* it ſelf, which I deſign'd to have open'd with a Lancet, being touch'd with a cauterizing Iron (which in making the Experiment there was occaſion to make uſe of) pour'd out the Blood very violently, and at firſt without any very remarkable pulſation, but after ſome time diſcernable enough, both as to the Blood and Membrane too.

I cut this *Sinus* through almoſt the length of it, to ſee whether any Arteries (whereof many, according to *Vieuſſenius*, which was alſo long afore affirm'd, and that upon Experience too, by the learned *Wepfer*, did terminate in it, and ſo occaſion its beating,) would diſcover themſelves by throwing out their ſalient Blood, but no ſuch Sign appear'd. *Wepf.* p. 116 par. 1.

After all which 'tis manifeſt the *Sinus*'s themſelves have no pulſation, other than what is communicated to them from the ſubjacent Brain, which contrary to what *Bourdon* affirms, hath an evident pulſation through the multitude of Arteries diſperſed thro' it *Bourd.* p. 196. par. 2.

it ſo forcible as to create a ſenſible *Syſtole* and *Diaſtole* in its outward coverings.

'Tis worth noting, that while the Blood-veſſels are all full, ſo as to keep the *Dura Mater* upon its full ſtretch, the pulſation is not viſible at all, or at leaſt very faintly; but after a depletion of the Veſſels, ſo, as that grows ſomewhat more lax, the beating becomes very viſible, equally in the *Sinus* and Membrane too.

After having made this Experiment I found one Author of the ſame opinion, and that is *Falloppius*, who in vindication of *Galen* againſt *Veſalius*, his Contemporary, ſays, all I have ſaid upon the foregoing Experiment, and all the great *Veſalius* was able to anſwer in his own vindication in his ingenious Book call'd *Anatomicam Gabr. Falloppi Obſervat. Examen*, falls very ſhort of its aim.

As to the Tranſverſe Ligaments which are in ſome places * round, cordal, and in others † broad or membranous, in the Longitudinal *Sinus* chiefly, both ſerving for Strength and (in concurrence with the cruciform ligamentous Fibres, taken no-

* Fig. 4 r.

† Ibid. x.

tice of by *Vieuſſenius*, on the under and outſide of this *Sinus*, from whence the Fibres belonging to the falcated Proceſs aforemention'd ſeem to have their original,) Elaſticity to this part for its more vigorous reduction of the Blood paſſing through it, together with its blind Cavities or Diverticulums ſerving to moderate the overſwift or violent motion of the Blood; ſeeing I find them ſo exactly deſcrib'd by *Vieuſſenius*, to whom the Reader may have recourſe, I think their deſcription need take up no room here.

But as to the manner of the Veins entring this *Sinus*, I find it far different from that which is deſcrib'd by *Lower* firſt, and afterwards by *Vieuſſenius*, both whom make them enter with their Orifices from behind forwards, (two or three only excepted by *Vieuſſenius*) and that for ſome other uſeful purpoſes than what have hitherto been taken notice of. *Low.* fig. 4 h h. *Vieuſſ.* tab. 2 D D, *&c.*

And this is as follows, (*viz.*) About one half of them (tho' intermixedly) (but all, after having firſt upon their arival at the *Sinus* inſinuated themſelves for ſome ſpace after the manner of the *Fig.* 4. dd, *&c.*

the Pancreatick Duct or Ureters firſt
lb. dd, &c. taken notice of by *Lower*, betwixt the Duplicature of the *Dura Mater*) from behind forwards, the other half from before backwards, as in the Figure.

Now, by this contrivance 'tis plain, that firſt of all there are made two contrary Torrents in one and the ſame Channel, by which means the refluent Blood, made poor by the vaſt quantity of its richeſt parts drawn off as it were into Animal Spirits, thro' a colliſion of Parts, which by this contrivance muſt needs fall out, is preſerv'd in its due mixture, which when at any time loſt through the languiſhing of its inteſtine motion or elaſticity, retards even its circular or progreſſive motion, which when it happens but in ſome degree, is the cauſe of many Diſtempers; and when altogether, of Death it ſelf.

In the next place the circulation is at all times not only ſomewhat retarded, and the Blood hinder'd, (together with the help of the bony Cell at which the internal Jugular Veins enter the *Sinus's*) eſpecially in an erect poſture, from deſcending with that rapidneſs and weight it would

otherwiſe have done upon the deſcending *Cava* to the Heart; but alſo much more ſo retarded in a ſupine poſition of the Head, a poſture moſt natural and ordinary for Mankind to take their reſt in, through which contrivance, in concurrence with that of the Lateral *Sinus's*, (whoſe ſtructure is ſuch, that in the aforeſaid poſture the Blood is forced to climb upwards before it can arrive at the place of its deſcent into the Jugular Vein) there is made a more plentiful generation of Animal Spirits, one chief Cauſe of the great refreſhment and vigorous diſpoſition of the whole Body we find after Sleeping.

As to the other manner of the Veins entring this *Sinus*, (*viz.* from before backwards) it from thence happens, that in a prone Poſition of the Brain, a poſture not uncommon amongſt Men, the Blood is help'd forward in its circulation through the *Sinus*; the truth and deſign whereof are at once both evident and pointed at by Nature from the Structure of this part (and which therefore ſhews the great uſefulneſs of Comparative Anatomy) in Brutes, who by reaſon of ſuch

ſuch a Poſition, which the neceſſity of Feeding almoſt always keeps them in, have always ſuch a diſpoſition of this Part, to aſſiſt the Blood in its heavy circulation.

The deſign of Nature in making theſe Channels ſo wide on a ſudden, in reſpect to the Branches of Veins lately treated of terminating in them, ſeems to correſpond with the conformation of the Parts juſt now treated of, and with that it had in making the Ramifications of Arteries afore taken notice of ſo large and unproportionable to the Trunks from which they ſpring, which is a ſlower than ordinary circulation of Blood through the Brain, in order to make a ſtill more copious production of the Animal Spirits ſo called. Which profitable Deſign and End of Nature had nevertheleſs been attended with a very great Inconvenience, (*viz.*) an extravaſation of too much *Serum*, the uſual effect or conſequence of a ſlacken'd Circulation, had it not been for another provident Contrivance of Nature in the two Communicant-branches, betwixt the Carotid and Vertebral Arteries aforemention'd,

p. 36. by the narrowneſs of whoſe Channel the influent Blood is in ſome meaſure repreſt in its motion, and an overcharging the Veſſels with Blood prevented.

Theſe *Sinus's* differ in ſtructure one from another, the Longitudinal and Lateral ones having many tranſverſe Ligaments which the other have not, and the Longitudinal having many ſmall Cavities or blind Diverticulums, as aforeſaid, which the Lateral have not; the uſe of them all being for ſtrengthening and defending them from giving way to the violent irruption of Blood into them, againſt which ſometimes notwithſtanding they are not able to defend themſelves; as I have ſeen in many Skulls ni which the Blood hath burſt open the ſides of the *Sinus's*, and found its way between the Duplicature of it, ſo as even to have made a *Fovea* or Cavity in the *Cranium* it ſelf, as was before noted, one of which I have now by me.

CHAP.

CHAP. VII.

Of the Plexus Choroeides.

THIS *Plexus* is an aggregate Body made up of *Arteries*, *Veins*, *Membrane*, and *Glands*, double on each ſide, (which hath not before been taken notice of) and conſequently having two Originals.

FIG. 1. ee. The firſt Original is from the foremoſt Branch of the Communicant Artery, which running backward up betwixt the hinder Lobes of the Brain, (in which for ſome part of the way it is immerged, and to which it gives many large Branches) and the *Medulla Oblongata* at length arrives FIG. 5. ee. at the Lateral Ventricles, and makes one part of the *Plexus* on each ſide.

The ſecond Original is from the hindermoſt Branch of that Communicant Artery, which running more backwardly, aſcends betwixt the hinder Limbs of the Brain and the *Cerebellum*, till it comes to the *Iſthmus*, where

FIG. 1. *ſecond* ee.

where communicating with the first Branch abovemention'd, they make a reticular broad Expansion, which covers both *Nates*, *Testes*, and *Glandula Pinealis*, and constitutes the second or other part of the *Plexus Choroeides*.

FIG. 5. GG

The first Branch begins to divide it self into divers Network Fouldings, interspersed with Glands somewhat before it enters the Ventricles, and continues such to its Extremity on each side, where they both under the *Fornix* wind cross the third Ventricle into a mutual inosculation.

Ibid. 5.

The second begins to assume the same shape or contexture as soon as it begins to enter the *Isthmus*, continuing such throughout its entire abovemention'd Expansion.

These two on each side are joined together by a twofold connexion, the first is by an Artery running under the *Bombyces*, intervening betwixt them, which could not be here inserted so as to come in view.

The second is by a production of the *Pia Mater*, which is extended all over these parts of the Lateral Ventricles, and the third Ventricle which lyes

lyes betwixt the first two parts of the *Plexus* forwardly, and down to the other two hinder parts of the *Plexus* backwardly under the *Fornix* and *Septum Lucidum*; so that whatsoever Water is transmitted out of these Ventricles, must slip down not only under the *Fornix*, but that Membranous Production it self; from which kind of structure and position of this Membrane may probably be understood how there might happen such an *Hydrocephalus* as the learned *Tulpius* mentions, in which there was found above two pounds of Water in one Ventricle, without any at all in the other: and such another as *Wepfer* mentions, where the Water causing the *Hydrocephalus* in an Heifer, was found contain'd in a *Cystis*, and that only in the left Ventricle too: for, supposing this membranous production of the *Pia Mater* to be double here, as it certainly is in all other places, 'tis not difficult to conceive, that the Water which is extravasated must needs insinuate it self betwixt the two *Lamina's*, till by a continual encrease it extends them into the shape of a large Bladder, such

Tulp. lib. 1. cap. 24

Wepf. p. 69

ſuch a one as the latter found there and drew out with his Fingers; and that which ſeems to put out of all Controverſie that it was ſo, is, that in thoſe places, both above towards the *Corpus Calloſum*, and below on the Baſis of the Ventricle, he found ſome ſort of Aſperities as though the Bladder fill'd with Water had been covered with ſome ſmall Protuberances not much unlike to White Poppy-ſeed, in thoſe places where it was contiguous to them; which Protuberances doubtleſs were the ſmall Glands interſperſed quite through this *Plexus*.

How this Diſtemper came to be on one ſide only, though ſometimes it is on both, as you may ſee in another place of the aforeſaid *Tulpius*, may likely enough be from an Adnaſcency of both the *Lamina's* of this Membranous Production, in that place where the *Septum Lucidum* ſinks down from the *Fornix*, occaſion'd by ſome ſmall ſort of preſſure of the ſuperincumbent Brain. Beſides theſe Veins, which are very truly deſcrib'd by *Willis*, I have always found two more meeting the fore-

Willis p. 10 col. 2. par. 1.

foremoſt Extremities of this *Plexus*, from between the two firſt Lobes of the Brain, where it ſeems to end under the foremoſt part of the *Corpora Striata*, by which it is there fixed and as it were kept in its due ſituation: and from theſe Branches are on each ſide ſent forth many more little ones to the *Corpora Striata*, and ſeveral other parts adjacent.

To this *Plexus* belong alſo Veins, which from the Extremities of that part of it in the Lateral Ventricles
Fig. 5. hh. begin to come into two diſtinct pretty large Trunks, running down thro' the middle of the third Ventricle, as far as the fourth *Sinus*, and there receiving ſome Branches from the other hinder part of the *Plexus* ſpread over the *Iſthmus*, diſcharge the refluent Blood into that *Sinus*.

Ibid. qq. But beſides this ſort of Reductory Veſſels, it hath alſo another, (*viz.*) *Lymphæducts*, which I firſt diſcover'd in the Brain of a ſtrangled Body, and ſhew'd to ſeveral then preſent, running in different ramifications amongſt the reticulated Veſſels and Glands of this part: Which Obſervation being added to that of the great Anatomiſt

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Anthony Nuck, who in that curious Piece call'd *Adenographia* ſays, he ſaw one coming from the *Glandula Pinealis*, and that his Friend another Anatomiſt, whoſe Name he mentions not, (but I know it was one *Bodivol*, whom I had the Happineſs to be very well acquainted withal, now dead) ſent him word, he ſaw another not far from the aforeſaid place; may be of ſufficient authority to evince the real Exiſtence of theſe Veſſels hitherto ſo much enquir'd after, in the Brain as well as in other parts of the Body. *Nuc.* p. 150.

The Glands belonging to this *Plexus* are very many, but very ſmall, and their Uſe, according to all the Moderns, eſpecially *Willis*, *Duncan*, and *Vieuſſenius*, to carry off the redundant watery part of the Blood, but that without ever ſhewing by what rational contrivance of Structure it can be done, ſeeing none of them aſcribe a Secretory Duct, which muſt always be in readineſs when any unprofitable part is to be diſcharg'd.

Since therefore this part is found furniſh'd with *Lymphæductis*, 'twill be no hard matter to conceive the genuine uſe of the Glands, which is, to ſepa-

ſeparate a rich nutritious Juice from the influent Blood, and by the *Lymphæducts* to refund it to the refluent, after the loſs of its nobleſt parts left behind in the Brain, in its paſſage to the Heart again.

It may alſo, for ought I know, according to the Opinion of *Willis*, ſerve to warm its neighbouring parts the Internal Superficies of the Brain, which being purely medullary, hath not ſo plentiful a ſhare of Blood-veſſels diſperſed through it as the reſt, and conſequently, to maintain an equality of warmth conducing ſo much to the conſerving the Spirits in their due vigour and exerciſe, muſt borrow an additional ſupply from hence. It is ſituated upon the middle of the *Thalami Nervorum Opticorum*, all-along them length way, and, contrary to what *Willis* ſays, is, by vertue of ſeveral Blood-veſſels, join'd to that medullary part of the Brain ſo call'd, immediately lying under it.

CHAP.

CHAP. VIII.

Of the Rete Mirabile.

NOtwithſtanding the Opinions of the late *Wepfer*, *Willis*, and *Vieuſſenius* too, (which two laſt indeed, tho' but now and then, are willing to allow it an exiſtence only in Men, (who nevertheleſs, if the Suppoſition of *Willis* be true, *viz.* That ſuch cannot but be Fools) had better be without it,) together with almoſt all the Ancients, as *Veſalius*, *Columbus*, *&c.* to the contrary, I have never found this *Rete* wanting, or with any difficulty diſcoverable in Men, ſpringing from and lying on the inſide of each Carotid Artery, in that place of the Circular *Sinus* chiefly which looks into the four abovemention'd inferiour and ſuperiour *Sinus's* in the Baſis of the Brain, and in ſome meaſure alſo the whole length of the *Sella Turcica*, on each ſide, between the Gland and the Carotid Artery. *Willis* pag. col. 2.

And that it is ſo ſmall in them with reſpect to what it is in Brutes of ſeveral kinds, is no way ſurprizing, when conſideration is had to the Uſe and Service of it in thoſe Creatures,

who,

who, by reaſon of their prone Poſition, would otherwiſe be in danger of having their Brains deluged as it were with an over-great quantity of the Influent Blood, and of a Rupture of the Veſſels, by its violent ingreſs, and this Danger ſo much the more threatned by how much the ſame Cauſe which brings it into the Brain with that force is equally as great and effectual to hinder its proportionable return; for the relief of which Inconveniency Nature hath contriv'd a means of its more eaſie and ſafe deſcent into the Brain, by turning that one large Stream of Blood, (which through its being penn'd in one Channel, becomes ſo rapid) into many more, (by which means the Carotid Trunk above the *Dura Mater* in thoſe Creatures is very ſmall to what it is beneath, whereas that Artery in Men, *&c.* hath the ſame bigneſs on both ſides that Membrane,) and they not only reticulated and contorted for the more ſlow and laborious (which Contrivance the Ancients thought was only for a more exact preparation of the Blood for Animal Spirits) deſcent of the Blood, but alſo many of them by their inſertion into the *Glandula Pi-*

tuitaria, attended with ſmall Veins iſſuing thence, to take off ſome part of the burden too.

This laſt contrivance of Nature methinks may be ſufficient to render that Controverſie of *Vieuſſenius* with *Willis* (which, before them, was betwixt *Walæus* and *Rolfincius*) the two latter on each ſide denying this *Rete* to have any Veins, very needleſs; ſeeing that if the Pituitary Gland have any, which I am confident it hath, (notwithſtanding the poſitive Aſſertion of *Diemerbroeke*, in order to ſerve his own moſt unprobable Hypotheſis, to the contrary) as having ſeen them plain injected with Wax; then this part of the Blood in ſome of the Branches of the ſaid *Rete*, which are plainly inſerted into the Gland, is equally capable of being reduced by thoſe Veins without any neceſſity of having recourſe to thoſe remote Branches *Vieuſſenius* hath been forced to ſeek for, as if it had had them of its own. *Vieuſſ.* p. 46 par. 2. *Diemerb.* p. 364. par. 3. *Vieuſſ.* p. 46 par. 2.

And that to the aforeſaid Poſition of different Creatures ought chiefly to be aſcrib'd the variety of Magnitude of this *Rete* in ſeveral of them, its ſize in *Dogs* ſeems highly to evince; in

in which, by reaſon of their Horizontal Poſition, being neither ſo prone as ſeveral Brutes who feed on Graſs, nor ſo erect as Man, that *Rete* is found ſmaller than in the firſt, and larger than in the laſt.

Another Uſe it hath been thought to have, is, to carry off a conſiderable quantity of a dull watery part of the Blood, in order to the production of the finer Animal Spirits; and this it is thought to effect by means and help of the Pituitary Gland, betwixt which and it ſelf there is conſtantly obſerv'd a great affinity, the one being either greater or leſſer in proportion as the other is ſo, and betwixt which there are in all Creatures, but more remarkably in thoſe where they are both large, a diſtribution of ſeveral Branches coming from the aforeſaid *Rete*. And this is look'd upon by *Vieuſſenius* ſo conſiderable an office of the *Glandula Pituitaria*, that in thoſe Creatures where it is but ſmall, as in Men, Horſes, Dogs, &c. he hath ſubſtituted many, but particularly two Cavities, for that uſe in the Wedglike Bone, juſt under the *Sella Turcica*, in which he ſuppoſes that *Vieuſſ.* p. 102 par. 3.

part of the aforeſaid *Serum*, which by the ſmallneſs of the *Rete* cannot be return'd that way, is remitted by ſeveral little Arteries ſlipt off from the Carotid, whilſt under the *Sella Turcica*, terminating in the two abovenamed Cavities, there either depoſing a part of the *Serum* to be carried off by a ſtrange way he there mentions, (*viz.*) by two holes, into the Noſtrils, and thence into the Fauces; or elſe by certain Veins meeting them in that place, as their proper Reductory Veſſels, to the Heart. *Vieuſſ.* p. 9. par. 2.

Now, as to this office of the *Glandula Pituitaria*, I cannot eaſily be perſwaded it is either deſign'd for, or capable of it, till ſuch time the Abettors of this Opinion can be able to ſhow me it furniſh'd with an Excretory Duct for this purpoſe.

And if they offer, that the Veins are ſuch, I reply, That (beſides its being very unprobable that ſo vaſt a quantity of Blood as continually is brought by the Carotid Arteries to the Brain, ſhould be able to get rid of any conſiderable quantity of its Seroſity, by ſo ſmall a part as the *Glandula Pituitaria* is;) 'tis not the uſual

uſual way of Nature to part with any Share of its Juices out of its Veſſels, when ſo unactive and unprofitable as this is, and immediately to receive it in again, ſeeing it is provided of Emunctories enough to convey it away by.

Moreover, granting (which by no reaſonable means is to be granted) it were ſo as they would have it, yet nevertheleſs, in conformity to Nature's proceedings in all ſuch-like caſes, there ought to be an intermediate paſſage by way of a Secretory Duct, which none hath been able hitherto to diſcover.

And ſo far as *Vieuſſenius* ſeems to be of this opinion, which in one place he plainly is, making it of ſo groſs and viſcid a nature, as is only fit to be diſcharg'd at the Emunctory of the Noſe; the ſame Reply is ſatisfactory: But when by way of flat contradiction to himſelf he comes to make the ſame groſs Humour a perfect fine *Lympha*, the Anſwer is then, That there is no need of parting with it beforehand, ſeeing we find that Liquor only ſeparated by the *Lymphæducts* of the Brain afterwards. *Vieuſſ.* p. 102 par. 3. *Vieuſſ.* p. 54 par. 1.

Seeing therefore there is such an affinity as before mention'd, between the *Rete Mirabile* and *Glandula Pituitaria*, and taking it for granted, that the office of the *Glandula Pituitaria* is not what it hath generally hitherto been believ'd, to the end we may attain a more exact knowledge of what it really is; it seemeth not altogether immethodical to take that part into consideration in the next place, together with the *Infundibulum*, which last hath not only as near a relation to the Gland as the Gland hath to the *Rete*, but such a close communication with it, that it seems in a manner almost impossible to treat of one independently on the other.

CHAP.

CHAP. IX.

Of the Glandula Pituitaria, *and* Infundibulum.

THIS Gland is ſeated in and fills up in a manner all that ſpace contain'd within the *Sella Turcica* (Veſſels only excepted).

'Tis cover'd on all ſides with the *Pia* and *Dura Mater*, excepting that part on its upper Superficies, in which there is a little round hole, by which the *Infundibulum* deſcends ſlopingly into it, being at its entrance inviron'd with a Production of the *Pia Mater*, for its more firm connexion with that part, as was before noted.

But as to the *Dura Mater*, it encompaſſes it after a far different manner than what *Vieuſſenius* hath deſcrib'd, not ſuſpending it in Man as it doth in Brutes, ſo as to hinder it from touching the bottom of the *Sella*, and that foraſmuch as there is not the ſame reaſon for its ſo doing in one as there is in the other, for in

Vieuſſ. p. 51 par. 5.

Brutes the *Rete Mirabile* is not only ſituate on each ſide this Gland, but runs quite under its hinder part, by which one ſide of the *Rete* communicates with the other, a Diſpoſition of this Part which *Vieuſſenius* was altogether unacquainted with; whereas in Man, inaſmuch as there is not that ſort of Structure in the one (*i. e.* the *Rete*) 'tis not neceſſary it ſhould be requir'd in the other.

However, in neither one nor the other is the Reaſon which *Vieuſſenius* gives for Nature's contrivance of this affair of any weight, ſeeing neither the *Rete Mirabile*, much leſs the few ſmall Veins belonging to the Bone beneath, could poſſibly any way be compreſſed by this Gland, though ſuperincumbent, becauſe it is ſo firmly knit to the *Dura Mater*, lying above and upon it, which is ſupported by the two foremoſt and hindermoſt Proceſſes of the *Sella Turcica*, in ſuch a manner as is ſufficient to ſuſtain and keep from preſſing upon any ſubjacent part ten times a greater weight than the *Glandula Pituitaria* is. *Vieuſſ.* p. 50 par 1.

Moreover, the *Dura Mater* is ſo far from ſuſpending it from that Bone,

Bone, that it is, together with the Gland, fixed to that very Bone it ſelf.

The ſubſtance of this *Gland* is far differing from that of all the reſt, which I have often upon this account particularly examin'd; in conſiſtence indeed 'tis the ſame with moſt of the Conglobate kind, if not ſomewhat harder, but then being preſſed or ſqueezed, it emits much more Water than any of them.

As to the Conglomerate ſort, it hath not the leaſt reſemblance to any of them, and conſequently cannot be ſuppos'd, as it hath hitherto been by all, to carry off any excrementitious or unprofitable part of the Blood.

Now, if we conſider this part, together with the appended *Infundibulum*, we ſhall certainly find a conformation far different from any other part in the whole Body of Man, inaſmuch as that which this Gland receives by the *Infundibulum*, or which is the ſame, what this *Infundibulum* conveys to it, is not ſeparated from the maſs of Fluids by any viſible Secretory Duct, which in its ordinary method Nature is obſerv'd conſtantly to make uſe of, whenſoever it

it parts with any part of the Blood, whether excrementitious or reductitious, throughout the whole compages of the Body.

Nor hath the manner of Nature in tranſmitting a certain Liquor to the Gland been leſs abſtruſe in carrying it off from that part again, the reductory Veſſels from the Gland being equally conceal'd, as the adductory to the *Infundibulum*; that way of Tranſudation, according to the invention of *Vieuſſenius*, being to the greateſt degree improbable, as having no reſemblance to the courſe of Nature throughout the whole Body.

Nay, even a poſſibility it ſelf ſeems hardly allowable, if we take but notice of that part in Brutes in whom its Integuments are extraordinary denſe, the *Dura Mater*, as he truly obſerves, inveſting it cloſe on every ſide, (and which he perceiving, and conſequently foreſeeing what might from thence unanſwerably be objected againſt him) was forced to make them much more than in Men; in which laſt indeed there is ſeemingly ſome reaſon for its being ſo, inaſmuch as the *Rete* lies in a Duplicature as it were of the *Dura Mater*, on each

Vieuſſ. p. 51 par. 2.

each ſide of the hindermoſt part of the *Sella Turcica*, as tho' one *Lamina* of it was ſpread upon the ſubjacent Bone, and the other over the *Pituitary Gland*, (a diſpoſition contrary to that in Brutes, as hath already been taken notice of) but nevertheleſs there is no neceſſity that it ſhould be ſo divided in this place, nor doth the ſaid Author ever offer a Reaſon for its being ſo, (which looks as though his Aſſertion was only a Gueſs) ſeeing this Membrane can ſend out new Productions as well double as ſingle, as we find in its two eminent Proceſſes before deſcrib'd, and *Sinus's*; agreeable to what it alſo therefore may and does do here, where the Integuments of this part appear plainly to be of too thick a conſiſtence to admit of his imaginary way of tranſudation, which is manifeſt not only by ſight and ſection, but in that by the greateſt force made uſe of in compreſſing and ſqueezing it between ones Fingers, we find it impoſſible to force out the leaſt appearance of Humidity through its aforeſaid Incloſure or Integuments.

Being therefore very inquiſitive after the true uſe of this part, and

deſpai-

deſpairing of ever attaining to ſuch a Knowledge without firſt knowing the exact Structure thereof, beſides all other means commonly made uſe of in all Anatomical Enquiries, I made uſe of all ſorts of Injections ſerviceable to ſuch an end, as of tinged Liquors, Wax, and Mercury, but all with little, if any, ſucceſs according to my expectation, the Wax not penetrating its Texture at all, the tinged Liquors but very ſuperficially, and the Mercury, (where my chief Hopes were) always by its weight (do what I could to the contrary) either breaking through the ſides of the *Infundibulum*, where it leaves the Brain, or elſe falling down in greater *Globuli* than the extream narrow Paſſages were capable of admitting, and by this means became altogether uſeleſs.

Being compelled therefore for the preſent to leave off a little while a further enquiry into the Structure of this part, by reaſon of the great miſt it is involved in, and to gain a little more Light for our Guidance in ſearching after Truth, (which like many other things of greateſt value lyes deep, and is with

with great difficulty acceſſible) it may not be amiſs to ſee what Aſſiſtance can be had, by making diligent Scrutiny into the Structure of its Appendix the *Infundibulum*.

The Infundibulum. This is a thin medullary Duct, covered with the *Pia Mater*, deſcending from the internal Concave Superficies of the Brain, to which, by reaſon of its wideneſs towards one end, and narrowneſs towards the other, in reſemblance to a Tunnel, as well as by reaſon alſo of the parity of their Uſes, the Ancients gave the Name of *Infundibulum*.

In Man it is cloſely inveſted with the *Pia Mater* at its very entrance into the Gland, and from that place hath not any manifeſt Cavity I could diſcover by blaſt or ſtyle, but is altogether of a medullary ſubſtance, contrary to what it is in Sheep or Calves, in which laſt Creature, where the Parts are larger, by inſerting a Blow-pipe into that part of the *Infundibulum*, next to the Gland, I have ſeen its further Tract or Paſſage on the upper part thereof a little puffed up, and a conſiderable

ſiderable quantity of Water regurgitate, as though it had lain contain'd either in ſome Pipes or Porulous Subſtance of that Gland.

This Difference is not taken notice of by *Vieuſſenius*, and therefore what he ſays of this part ſeems chiefly in this reſpect, if not altogether, applicable to the Structure it hath in Men.

Thoſe two Diviſions or Ramifications of this part the ſaid Author mentions, one forwardly, and the other backwardly, in Sheep, Calves, *&c.* I have always found correſpondent to the Deſcriptions he there gives of them; but whether the firſt be protended ſo, and terminate after the manner he there deſcribes I ſomewhat ſcruple, ſeeing I have always obſerv'd the Extremity of that part in Brutes, towards the foremoſt part of the Gland, ſinking as it were into the very Subſtance thereof, and afterwards becoming preſently altogether imperceptible, and in Man the termination thereof juſt after the ſame manner, ſave only that in the laſt it happens forthwith upon its approach to the Gland, with- *Vieuſſn.* P. 49. par. 3.

without being protended either backwardly or forwardly.

The Uſe of this part is certainly to convey ſome ſort of Humidity from that great concamerated Cavity within the Brain, reſulting from its inward complication of parts, to the Pituitary Gland, and the office of it is to receive and carry off this tranſmitted Humidity; but as to how either this Humidity is collected in the aforeſaid Cavity, or how, when convey'd into the Gland, it is carried off, we are ſtill as much in the dark as ever.

I know very well there is nothing more eaſie with the Viſionary Philoſophers than ſuch a Knack as this; and now I think on't, the great *Willis* makes nothing of turning a Vein into a *Lymphæduct* in the *Glandula Pinealis* and *Plexus Choroeides*, no leſs than which does alſo the accurate *Vieuſſenius*, in the *Plexus* belonging to the fourth Ventricle; but how conſonant this is to the rational ſtructure or mechaniſm of parts, neither the one or the other have been ſo kind as to explain.

Will. p. 46.

Vieuſ. p. 110 par. 3.

Now

Now, as to the *Plexus* and *Glands* before mention'd, 'tis evident by what hath been already diſcover'd and accordingly given an account of in the preceding Pages, they are furniſh'd with *Lymphæducts*, as proper reductory Veſſels; ſo that ſo far the Prophecy is vaniſh'd.

But as to the remaining Gland, I am not ſo fond of gueſſing to ſay it hath any, and conſequently all I can ſay is, that as I look upon the *Infundibulum* to be no more than a large *Lymphæduct* variouſly ramified through the *Glandula Pituitaria*, diſcharging its Liquor by thoſe many ſmall Branches into the Veins diſperſed through that part to be reduced after the manner 'tis in all other Secretory Glands back to the Blood again.

And that which ſeems moſt to favour this Conjecture, is the extraordinary humidity of this Gland, eſpecially in Brutes, above the reſt of the whole Body, as ſerving not only to export what *Lympha* is ſeparated from ſeveral Arteries diſperſed thro' it, but that alſo which it is charged with from the Brain it ſelf.

And

And to this twofold manner or double office of Secretion is owing the two diſtinct Subſtances it ſeems to conſiſt of, the one being accommodated to that part of the *Lympha* coming from the Brain, and is therefore whitiſh, the other to that ſeparated immediately out of the Blood, and is therefore reddiſh.

Laſtly, As to the manner how the *Lympha* paſſes down thro' the *Infundibulum* from the Brain to the *Glandula Pituitaria*, I look upon it to be in the form of condenſed Vapours ariſing from the Arteries of the *Plexus Choroeides*, emitted thence for the keeping moiſt and in good order that inward Production of the *Pia Mater*, ſpread all over its *Parietes*, which being a membranous dry part of it ſelf, might otherwiſe become injurious to that fine medullary part lying under and being contiguous to it; in which there is a continual motion of Animal Spirits, whoſe Tracts, and conſequently they themſelves, through any the leaſt intemperance of this Membrane, would be in great danger of either ſome obſtruction or diſorder.

And that this *Lympha* is only the reſult of the aforeſaid Vapours, I am the more readily enclin'd to believe, becauſe I never ſaw Water in that part of any ſound Brain, nor unſound neither, where the *Plexus Choroeides* was firm; and there was no reaſonable ground, by the extravaſation of *Serum* in ſome other remote parts of the Brain, to believe it had its riſe from thence.

CHAP.

CHAP. X.

Of the Glandula Pinealis.

THE Gland call'd *Pinealis*, from its Figure, is about the bigneſs of an ordinary Pea, prefix'd to the two Prominencies call'd *Nates*, hereafter to be deſcrib'd, at the end of the third Ventricle, immediately under the broad and hinder part of the *Fornix*, (with which nevertheleſs it hath no connexion, as *Vieuſſenius* *Vieuſſ.* p. 71. ſaith it hath) and over that part of the *Rima* in the third Ventricle call'd *Anus*.

'Tis joyn'd to the *Nates* by ſeveral Fibrous Roots, and becomes a ſupport to that part of the *Plexus Choroeides* there ſituate.

In an hydropical Brain of a ſtrumous Boy, I have ſeen it ſwelled to a ſize of three times its ordinary magnitude, and by reaſon of the abundance of ſtagnate gelatinous *Lympha* contain'd in it, perfectly tranſparent.

Hence it moſt plainly appears that this part is a meer Gland, and, by what was ſaid before conformable to what hath been obſerv'd in this hydropick Brain, of the Conglobate or Lymphatick kind, and by conſequence a very unfit part to be made a Receptacle for Animal Spirits, as *Vieuſſenius* makes it, and much more a place of reſidence for the Soul, according to *Des Chartes*. *Vieuſſ.* p. 71.

'Tis true, there are two fair medullary Tracts ariſing ſeemingly from the two Roots of the *Fornix*, ſtretching length-way upon the *Thalami Nervorum Opticorum*, as far back as this Gland, (by *Vieuſſenius* called *Tractatus Medullaris Nervorum opticorum Thalamis interjectus*, as though it was only one, and accordingly is ſo delineated by him, *Tab.* 7. GG, but indeed is two, one on each ſide) about which place they turn in, and by a tranſverſe bending kind of a Proceſs (by the ſame Author call'd *Tractus medullaris natibus antepoſitus*) unite, as he hath exactly obſerv'd: And this, doubtleſs, gave occaſion to the Error of *Des Chartes*, as *Willis* truly thought, (whoſe ſublime and moſt *Vieuſſ.* p. 64 par. 3. *Willis*, p. 9. col. 1. par. 1.

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deſervedly-admir'd Philoſophy had doubtleſs been much more uſeful, had he convers'd more with Diſſections, and leſs with Inviſibility) and *Vieuſſenius* too, (with whom in the ſame Miſtake doth agree *Muraltus* and *Willis*) for upon a more heedful inſpection (as was moſt evident in the Brain aforemention'd) it will be found that no part of the Proceſs aforeſaid, however near it comes to this Gland, does in any wiſe become continuous to it. *Mural.* p. 508. *Will.* p. 10. col 1. par. 3

Dr. *Wharton* alſo ſtumbled upon theſe medullary Tracts, placing them amongſt the Nerves themſelves, and aſcribes the ſame unreaſonable uſe to them as he does to the Nerves in many other Parts of the Body, (*viz.*) of ſeparating a ſuperfluous Humour from the *Cruca Medulla Oblongata*, or *Thalami Nervorum Opticorum*, (being the ſame Part, and only on the other ſide or upper part of the Brain, under another denomination) which he ſuppoſes to be the *Commune Senſorium*. *Whart.* p. 141.

It hath Arteries and Veins in common with other Glands, the Veins ending in the fourth or inward *Sinus*; as may the *Lymphæducts* too, when they are conſpicuous.

CHAP.

CHAP. XI.

Of the Brain *in general.*

THAT part of this Treatiſe relating to the Veſſels, being diſpatch'd, I ſhall in the next place proceed to an account of the Brain it ſelf, under which term are generally comprehended the *Cerebrum* and *Cerebellum*, and *Medulla Oblongata*, which Parts being in many reſpects ſo different one from another, may juſtly challenge a diſtinct and orderly deſcription.

The *Brain* then, in the firſt place, as diſtinct from the other two, is that large and almoſt ſpherical Body which comes firſt to ſight in the old way of Diſſection, filling the greateſt part of all that ſpace contain'd in the *Cranium*, conſiſting of two different Subſtances (firſt taken notice of by *Archangelus Piccolominius*) both in Colour, Conſiſtence, and Office, the one being more com- *Piccolom.* p. 252.

pact, white, medullary, or fibrous, the other ſofter, greyiſh, and glandulous.

The utmoſt *Malpighius* (by vertue of his Microſcopes) could do, was to diſcover the Cortical part to conſiſt of Glands of an oval depreſſed Figure, and in his Opinion, of the Conglomerate kind, (but that how properly, as alſo his calling the Nerves their Excretory Ducts, I leave to the Judgment of others) and the Medullary part to conſiſt of various Fibres immerged in and having their original from the aforeſaid Glands, deriving from them a certain Liquor call'd *Nervous Juice*, concerning the Exiſtence of which, in the uſual ſence 'tis taken in, as a fluid body, contain'd and running continually in the Channel of the Nerves, as Water in Wooden or Leaden Pipes, for either Nutrition or Senſation, is a thing ſomewhat improbable, it being not only poſſible, but very eaſie to reſolve thoſe two *Phænomena's*, the firſt from the Blood, and the other from the Natural Tenſeneſs of Senſible Parts maintain'd by the ſupply of a proper Liquor from the Blood,

Malp. de Cereb. Cort. p. 78, 81. par. 3.

Blood, both in their Originals and continued or elongated Productions; inaſmuch as it doth as certainly circulate in them as in any other parts of the Body. And as to the manner how this is done, it will appear very plain and intelligible, after the innate Structure of the Part hath been more accurately enquired into.

The Curious *Lewenhoeck* made a far deeper ſcrutiny into theſe two Parts, being very probably aſſiſted by better Glaſſes, and from what occurr'd to his view, called the cortical part a *pellucid Vitrious Oily Subſtance*, (the ſeeming oilineſs of which Subſtance I attribute only to the ſtagnating of the pure Liquor, growing cold after death of the Creature,) from ſuch a cloſe and regular Poſition of the *Globuli* ſwimming therein, as allows the Rays of Light to paſs them without refraction, contrary to what they do in the other or medullary part of the Brain, in which they are ſo diſpos'd that the Light cannot paſs them in right lines, and conſequently being a little diſtorted, makes them appear white,

Lewenh. de Struct. Cerib. p. 37.

white, notwithſtanding *Malpighius* on the contrary neither allows the Parts of the Brain to be diaphanous, nor the Animal Spirits to be any thing a-kin to Light. *Malpig. de Cereb. p. 2.*

'Tis true, even by his own confeſſion, that his moſt nice and diligent Inſpections could not free him from many Scruples about what he ſaw; yet ſome things to our purpoſe were plain enough, as Reticular Bodies of a red colour, which being larger in the Cortical Parts than Medullary, helps to give it that greyiſh or *ſubrunneous* colour, as he calls it.

Nextly, a tranſparent Vitrous-colour'd Subſtance contain'd in moſt minute Veſſels; whence 'tis plain there are two ſorts of Liquors in this Cortical Part, one of a red colour, or Blood, contain'd in larger Veſſels, whoſe *Globuli*, which give it its redneſs, either by reaſon of their ſize or figure, cannot enter thoſe ſmall Veſſels which with the Fluid contained in them conſtitute this tranſparent, cineritious, or cortical part of the *Brain*.

The

The other a tranſparent Liquor, contained in moſt minute Veſſels, as aforemention'd; from whence I am induced to believe this Cortical part to be only an Aggregate of different Veſſels, (as alſo I do of all the reſt of the Parts of the Body) containing different ſorts of Fluids.

Of theſe Veſſels ſome contain a more compound Liquor, commonly call'd Blood, which whilſt in that ſtate, by reaſon of the *Globuli* ſwimming on it, looks red, and by reaſon of a tubulous Pore of a proper ſize and figure ſo continued to the Veſſel we call a *Vein*, that it undergoes a continual quick circulation.

Another ſort of Veſſels there is which receive and contain a more ſimple fluid body, of a thin tranſparent nature, which when in ſome parts of the Body, gives the name of *Lymphæducts* to the Veſſels that it runs in; but when in theſe Veſſels, which are diſcover'd to make up the great Subſtance of the Brain, whether Cortical or Medullary, may be allow'd the name of *Fluidum Animale*.

And

And this laſt ſort of Veſſels I look upon to be either a certain Protenſion of an Artery, by its ſmallneſs render'd capable of holding ſuch a ſort of Liquor only as the laſt ſpoken of, or elſe ſuch a tubulous production of the Artery as by its Orifice or Pore anſwers to the figure and ſize of the Fluid it is by Nature intended to receive.

Upon the ſame exact Enquiry made by a Microſcope, the medullary part of the Brain appears to be of the very ſame conſtitutive parts, ranged only after a ſomewhat different manner, which makes this part appear more white, as was before obſerv'd. But over-and-above (if it may be allowable to make a Conjecture) I am enclin'd to think the Whiteneſs of this part may be owing in ſome, if not the greateſt part, to ſuch a narrowneſs of the Veſſels diſcover'd here, containing the pellucid Subſtance aforemention'd as will not entertain any Fluid whatſoever, without its being firſt reduc'd into very minute Particles, or *Septometry* ſo called: Which laſt Veſſels I therefore ſuppoſe to be only

only yet more Capillary Productions of the aforeſaid Cortical Veſſels, as they are of the red or Blood-veſſels indu'd with ſuch a Pore as fits them only for the reception of a moſt ſubtile, fine, ſoft Liquor, which I eſteem the true Medullary and Nervous Juice, which being contained in its proper *Capſula*, and many of them collected into one *Faſciculus*, at its egreſs out of the Brain, being there wrapped up in more thick and ſtrong Coverings made of the two outward Membranes of the Brain, do conſtitute that part we call a *Nerve*, which having all its Integuments or Membranous Incloſures always kept turvid and tenſe by its contain'd Fluid, after a ſlow and leiſurely manner continually diſpenſed from the Fountain, and by its growing more taper towards the place of its termination, by which means it acquires a greater ſtreightneſs or narrowneſs of its Pores ordinarily call'd *Fibrillæ*, it ſo falls out that all inward Impreſſions, upon all occaſions, are the more eaſily and ſpeedily tranſmitted through it.

The

The very ſame notion alſo concerning Nutrition (which in the trueſt ſence is only an appoſition of Parts nouriſhing to Parts pre-exiſtent to be nouriſhed) in the reſt of the Parts of the Body, I have thought reaſonable to entertain ever ſince, by aſſiſtance of the Microſcope I have plainly diſcern'd the Veins to be only continuations of Arteries, and the Blood to run in the ſame Channel variouſly modified, without the leaſt ſuſpicion of Extravaſation, (*viz.*) a continual tranſmiſſion of Nutritive Juice out of the Pores of Arteries, after many windings like Tindrils of Vines (*Analogus* to which the red Reticular Bodies of *Lewenhoeck* ſeem to be in the Brain,) grown very capillary into certain *Tubuli's* or Pores of a correſponding bigneſs and figure, making up the whole fleſhy part of the Body, whoſe Subſtance, when 'tis freed by waſhing or injection of Water, we ſee to conſiſt only of large and ſmall Blood-veſſels and Fibres; which laſt, whether Nervous or Membranous, or ſuch as relate to Muſcular Motion, commonly called *Carneous*, I ſup-

ſuppoſe to be full of minute diſtinct Veſſels for the communicating and receiving their proper Liquors or Fluids after the manner already expreſs'd, which as contain'd in the ſaid *Tubuli* or Pores, whilſt they retain their Natural Conſtitution and Proportion, I preſume it is which keeps the Habit of the Body plump and vigorous, the more thin and languid being perpetually carried back by the Lymphatick Veſſels, and a great part wholly exterminated by meer ſimple Tranſpiration; which I adventure to think is not only ſuperficial from the Sudorifick Glands in the Skin, but alſo through the whole Subſtance of inward parts, through ſmall *Canaliculi's* or *Meatus's* in even the *Viſcera* themſelves; by which, not unlikely, we may gueſs at the Meaning of *Hippocrates*, when he ſaid, *All things were conſpirable and tranſpirable.*

The minuteneſs of Veſſels is that which hath ſo embroil'd the Thoughts of Naturaliſts upon this Subject, and ſet Realities ſo remote from the Underſtanding, otherwiſe 'tis no Paradox to affirm the Exiſtence of *Vaſa*

Vaſo-

Vaſorum almoſt to *Infinitum*, ſome containing Liquids in a continual more nimble circulation, others in a gentle protruſion only: Which will appear altogether unſurprizing, if it be conſider'd that the aforemention'd Ingenious Author hath computed, that even the 64th part of a Miriad (*i. e.*) of a Ten hundred thouſandth part of any Subſtance but as big as a ſmall grain of Sand, cannot, eſpecially if of a rigid or inflexible nature, enter thoſe little Veſſels, which are ſeen in a retiform manner diſtributed amongſt, and fixed to the aforeſaid pellucid *Globules*, which ſwimming in thoſe little Veſſels, are diſcover'd to make up both the Cortical and Medullary part of the Brain. As alſo further, that even the tender Coats of the ſmalleſt of thoſe Veſſels which contain the aforeſaid moſt minute Globular Fluid Bodies, are alſo full of yet far more minute Veſſels than they themſelves are. *Lewenh.* p. 46. *Lewenh.*

Nay, I am ſo far from being ſurpriz'd at this kind of Vaſcular Conſtitution of Parts, that I apprehend not how Nature could otherwiſe have acted

acted without the conſequence of a boundleſs Accretion, inaſmuch as that when any parts of a Fluid become extravaſate, they neceſſarily loſe much of their progreſſive motion, and if of a groſs conſiſtence, are either proſcrib'd by the wider paſſages, or of a finer, through thoſe more ſtraight and elaborate (*viz.*) by Tranſpiration; ſo that what Particles of Matter ſoever continually arrive, for either the augmentation or reparation of the Parts, muſt (unleſs the ruine of the Subject do not firſt happen, as we ſee it often does in Diſeaſes proceeding from ſuch Cauſes) needs (if not confin'd in Veſſels) advance into a monſtrous preternatural accumulation, as being, by reaſon of their groſs conſiſtence, altogether uncapable of being carried off proportionably to the meaſure of their aggeſtion, in the form of ſubtile Steams or Exhalations.

Beſides a rational explication of the natural Functions which this Hypotheſis furniſheth us with, it alſo, ſeems to clear a great many Difficulties which have hitherto puzzel'd the moſt refined Phyſiologiſts relating to

the Animal Faculty, ſuch as are *Senſation* and *Muſcular Motion*; of which laſt here in the next place, the other being reſerv'd for the laſt Chapter, which treats of *Senſation* and *Motion* in general.

CHAP.

CHAP. XII.

Of Muſcular Motion.

TO recite the Opinion of others upon this Subject would be a thing altogether uſeleſs here, ſeeing an Abſtract of them is already extant in the *Philoſophia vetus & nova* by Mr. *Colbert*; and beſides, the moſt correct of them are not only very unprobable, but abſolutely repugnant to plain Reaſon and Matter of Fact too; an Inſtance whereof you may have in Dr. *Willis*'s Tendinous Reſervatories of Animal Spirits, in Dr. *Mayow*'s Twiſting or Fiddle-ſtring Fibres, with whom of late Mr. *Regis* agrees, by which the Muſcle muſt needs loſe a great deal of its thickneſs, than which nothing is more contrary to Experiment; in *Duncan*'s firſt and ſecond Element of *Des Chartes*, which he makes the Animal Spirits to conſiſt of, contrary even to the very Principles of that great Man's Philoſophy, which al-

Willis *de Mot. Muſc.* p. 35.

Mayow *de mot. muſc.* p. 73.

Dunc. p. 90

lows no Elaſticity to thoſe Bodies themſelves, though the Authors of it in all others; likewiſe in Dr. *Croon's* making the Blood it ſelf, as well as the Animal Spirits, ſo be mov'd by the power of the Soul to any Muſcles; as likewiſe the extravaſation of thoſe two Liquors firſt into the ſpaces betwixt the Fibres, and then their introvaſation into the Fibres themſelves again, in order to make inflation, an Error incident to the Immortal *Borellus* alſo, whoſe imaginary Diſcourſe upon this Subject ſeems of a very different Thread from the reſt of his Excellent Works.

Croon, p. 23, 24, 25, 33. *Philoſ. Coll.* p. 23.

Borel. *de mot. Anim.* p. ult. prop. 23. & *pluribus aliis locis.*

If therefore what hath been already ſaid about the Structure of Parts be remembred, (*viz.*) That the Medullary Part of the Brain is only a Contexture of Veſſels; that its Nervous Propagation or Nerve is alſo a Compages of Veſſels, formerly call'd Filaments, much more narrow than thoſe of the Brain it ſelf; and, that theſe Nerves produce, or at leaſt terminate in the Fibres of all ſorts of ſenſible Parts whatſoever, though of a different texture, as well

well as thoſe carnous ones of Muſcles, which laſt are tubulous, 'twill not be in the leaſt unreaſonable to inferr, That theſe Bodies being kept continually turgid with the contained Fluid, are equally capable of tranſmitting or receiving Impreſſions of the Object, as if they were ſtretched longitudinally like a Bow-ſtring from each Extremity, according as *Borellus* hath obſerved.

And as to *Muſcular Motion*, allowing only what may directly be inferred from what hath previouſly been ſaid, (*viz.*) That the Nervous and Carnous Fibres are only a congeries of Fluids contained in certain Veſſels communicating with each other, that by reaſon of a Plenitude in the aforeſaid Fibres, the whole Machine is in a conſtant *Equilibrium*, it will neceſſarily follow, upon the common *Poſtulatum*, (to which all Mankind muſt be beholden upon all ſuch Explications as theſe to the World's end) *viz.* that the Senſative or Rational Soul can command the Animal Spirits (which I call only a Nervous Fluid) into a

Primus Impetus, or local motion, that a part of that Liquor, whenever a Muſcle contracted is tranſmitted through the Veſſels which contain it from the great Reſervatory thereof, the Brain, to its Carnous Fibres, into whoſe Veſſels, being ſo much narrower than thoſe of the Nerves, even by vertue of the ſame force which moves it from the Brain, that Liquor is driven after a moſt rapid manner, (which Effect, to any acquainted with the nature of Fluids and mechanical Laws of Motion by Projection, needs not any demonſtration) cauſing the Intumeſcence or Inflation of the Muſcle, the ſame Liquor at the ſame time being driven back again with an equal ſpeed from the Antagoniſt Muſcle into the room of the firſt, which was tranſmitted from the Brain to the contracted one, in order to maintain the ſame Plenitude or (which is the ſame thing in the ſence of the old Philoſophers) to avoid a *Vacuum*. And if any object the wideneſs of the Paſſage it is to come back by from the reflexed Muſcle, as an impediment to an equivalent

equivalent ſpeed in that Liquors retroceſſion, I have to anſwer, that the Emptineſs being made firſt, is a ſufficient recompence for that.

And here I cannot but take notice, that all they who contend for Animal Spirits, analogous to thoſe we ſee produc'd from various Subjects by Fire, as the only adequate *medium* for all ſorts of *Muſcular Motion*, have been forced to have recourſe either to certain Tracts or Interſtices betwixt the Filaments of the Nerves continued from the Brain, or the Original of the Nerves through their whole Productions to the Muſcle, of which ſort are the *Carteſians*, or elſe to a certain Nervous Juice, for their place of reſidence, of which ſort are moſt of the Moderns, and particularly *Vieuſſenius*, by which Paſſages, or out of which Juice theſe fine inviſible things are either voluntarily, by the command of the Soul, or inadvertently, from ſeveral either inward or outward impreſſions, tranſmitted, in order to produce Motion: which if true, and the only ways of producing *Muſcular Motion*, I beg leave to ask, how it comes to paſs, by

either of these ways, that when another person bends my Arm, and that against my Will too, the bending Muscles of the Arm become as tumid as when voluntarily or inadvertently contracted at any other time; which hath been truly observ'd tho' not satisfactorily accounted for, by Dr. *Croone*, or any other I know of. *Croone, p. 7.*

But how this or any other sort of contraction of a Muscle happens, does by the other afore-mention'd Hypothesis become explicable, without any manner of difficulty at all: For when the Cause of Contraction is from the Command of the Soul, the pressure is first from the Fluid in the Brain, by which all the interjacent or continued Fluid flows towards the Part to be moved, the same proportion of Fluid being at the same instant transferred into its room from the relaxed Muscle; and when the contraction of the Muscle is from the above-mention'd external force bending the Arm against my will, then the Liquor contained in the relaxed carnous Fibres or *Vascula* is transmitted through the whole continuity of Fluids, to that which is contracted, and all this without being be-

beholden to the wild Conceits of a dry and moiſt part of the Nervous Juice, blind Paſſages, inviſible *Tubuli* betwixt the Antagoniſt Muſcles or Valves in the Nerves, by a meer *Æquilibrium* of the Fluids contained in the Veſſels the Parts conſiſt of.

At the ſame time I am not inſenſible of the Solution ſome have given this Inſtance of Involuntary Motion upon another Hypotheſis, (*viz.*) by ſuppoſing an equality of Tenſion or Elaſticity in all the Muſcles of the whole Body; by which means it falls out, that when any new additional force (though never ſo ſmall) is added to the Fibres of any Muſcle, as in voluntary motion, or the power of Elaſticity in the Antagoniſt Muſcle, overcome by outward force, as in the aforemention'd Inſtance of Involuntary Motion, the other Muſcle then becomes contracted.

Now, that this is one concurrent Cauſe in both ſorts of Inſtances, as being confirm'd by the Experiment of cutting a Muſcle through, either towards the Extreams or in the middle, by which the Fibres, by their na-

natural Elaſticity, are found to contract either to one or the other, or to both Extreams, is allow'd to be true; but to be the only Cauſe, is altogether as falſe.

For, in the firſt place, as to the caſe of voluntary Contractions, it is allow'd to proceed from a tranſmiſſion of Spirits from the Brain into the carnous Fibres, (that Hypotheſis of *Steno* to the contrary having been convicted long ſince by *Borellus*, in his Book *De Motu Animalium*) though not without the concurrence or ſympraxis of the natural Elaſticity of the Fibres belonging to the Muſcle to be contracted.

So likewiſe, without the tranſmiſſion of Animal Spirits from ſome force or another, I deny even the poſſibility of that ſtiffneſs or hardneſs which is eaſily preſerved in all contracted Muſcles, feeling and ſeeming as though they were indurated and ſwelled out, as really they are, whether it be in the caſe of voluntaty or involudtary motion; in confirmation of which, I affirm, that though by the cutting of the carnous Fibres of any Muſcle through, which way ſoever

ever it be, the contracted part may, and doubtleſs does, grow thicker by the ſhortning of its Fibres, yet by that means only it does not become ſtiffer and harder, ſo as we find Muſcles do when contracted by any natural Cauſe, nor is there any neceſſity it ſhould do ſo, according to any Rules of Mechaniſm, ſeeing the Fibres ſhortning only by their own elaſtick force, when they find the circumambient ſpace give way have no neceſſity of ſubintration of parts, which is always requiſite to procure a ſtiffneſs or hardneſs to a part altering its dimenſions as Muſcles do, from a longer and thinner to a ſhorter and thicker circumference; and upon this it muſt needs follow, that in a Muſcle contracted by involuntary force (in which Action the Brain is altogether unconcern'd) that ſtiffneſs or hardneſs then perceivable in it, muſt needs be owing to the Fluid or Spirits in the antagoniſt Muſcle, after the manner already explained, tranſmitted to it.

Now,

Now, to define what ſort of thing this Animal Fluid (ſo called) is, I ſee no occaſion to frame any other Idea of it than what we ordinarily have of the pureſt Liquors, ſeeing the Nerves are a Subſtance which (to the Senſes of either Smell or Taſte diſcovers very little elſe than what is inſipid) are always reckon'd amongſt the leaſt hot parts of the Body, and doubtleſs far leſs warm in Fiſhes than us, who yet have as great a ſtock of Animal Spirits as any other Creatures. And this Conſideration may be it was that occaſion'd an Author to give the Animal Spirits the Epithite of *Frigidiuſculi*. *Du Hm. T. 1. p. 78*

'Tis plain enough, that the Veſſels which contains this Fluid are extream minute, and conſequently the Content muſt needs be of a very fine and depurate conſiſtence, though without much reſemblance to either the aforeſaid nimble, ſaline, or ſulphurous Productions of the Fire.

'Tis in a continual, gentle, direct motion, though perhaps contained in curved or reticulated Veſſels, from its original ſource to the ends of the carnous Fibres, from whence it

it is convey'd into the Membranous or Tendinous Productions, according as the Fibres terminate, and it may be by filtration only; in which, as in other, and particularly in Glandulous Parts not ſubſervient to Muſcular Motion, where Nervous Ramifications are very copious, whether it be of any other uſe than to keep the Parts in their proper tone, in order to their regular diſcharge of the office of Secretion, muſt ſtill remain a Controverſie, notwithſtanding all that hath been yet advanced againſt it, inaſmuch as waſtings and numbneſſes of Parts, the common Symptoms of obſtructed or divided Nerves, (which doubtleſs by their haſtening through ſuch Cauſes to Muſcular Parts, gave the firſt riſe to that Conjecture about the Exiſtence and Uſe of that Juice throughout the whole Body) are equally explicable by the want of Tone, as of that ſuppoſed Liquor.

To the proof of all this an Experiment frequently made does not a little contribute, and that is the injecting the Arteries of a Dog, or any ſuch Creature, when dead, upon which there immediately happens

pens a contraction of the Muſcles, according to the different ſtrength of them, (*viz.*) of the Extenders in the hinder Legs, and of the Benders in the fore Legs, though the Injection be only of cold Water, the reaſon of which effect in particular, if it be remembred what hath been before obſerved, (*viz.*) that the Blood-veſſels do moſt certainly enter the compoſition of the Nerves themſelves, will not only become very eaſily explicable, but the whole Hypotheſis at leaſt very highly probable.

If it be ſaid, That this ſpeedy inſtantaneous reflux of the Animal Fluid is oppoſed by the aforementioned conſtant direct motion it hath from its Source to the parts to be moved, 'tis eaſie to reply, That its ſlow direct motion that way is eaſily overcome and repelled by the violent impulſe of the forcibly-relaxed Muſcle the other way.

If further it be demanded, by what means it ſo happens that in the Inſtance before us of an Arm bent by force, that the refluent Animal

mal Fluid is rather towards the Muſcle, which by that means then proves contracted, than towards any other whatſoever, to all which it may indifferently have acceſs, I think the Solution ſeems not difficult, if it be conſider'd, that at the ſame time that the one Muſcle is forced from, the other is forced into a contraction; from whence it ſo falls out, that the carnous tubulous Fibres of the laſt, which by being extended under the ſtate of relaxation, did loſe their cavity, muſt needs by their natural elaſticity, when freed from the preponderant force of its Antagoniſt, acquire it again, by which means a ſpace being made, the repelled Fluid, by the Laws of Libration, (to ſay nothing of the habitual motion of the Animal Spirits, or Liquor, by moſt Authors, eſpecially *Borellus*, urged as a Reaſon for this effect) muſt needs be driven thither.

In fine, though I am not averſe to think moſt of the *Phænomena* relating to Senſation and Motion may be ſolved by this Theory, tho' of ſo ſmall an *apparatus*, yet I am ſo far

far from being fond of it, that I have reſerved a far greater ſhare of Friendſhip for any other that may ſeem but of never ſo little more a-kin to Truth, and ſubmitting all I have ſaid on this Subject to the candid Sentiments of the more judicious Proceedee in deſcribing the other parts of the Brain as they offer themſelves in the uſual modern way of Diſſection.

CHAP.

CHAP. XIII.

Of the Brain *in particular.*

THIS Part being already deſcrib'd and conſider'd in general, as conſiſting of two different Subſtances commonly called its Similar Parts, and the Source of all Senſe and Motion, comes now to be taken notice of in a more particular manner, with reſpect to its diſſimilar parts or conformation; and this I think may beſt be done firſt according to its outward, and next to its inward appearance.

Outwardly 'tis convex and cortical, exactly divided into two Hemiſpheres by the firſt Proceſs of the *Dura Mater* called *Falx*, from the bony Proceſs called *Criſta Galli* forwardly to the very hindermoſt part of the *Cranium*, where theſe two Diviſions are ſtretched over the *Cerebellum*, from which part alſo 'tis perfectly ſeparated by the ſecond Proceſs of the *Dura Mater*, to the end it

may not cauſe any prejudicial compreſſion upon that part, either by its weight or pulſation.

The foremoſt Diviſion is made only as deep as the *Corpus Calloſum*, the latter to the very *Medulla Oblongata* it ſelf.

'Tis further imperfectly divided into four Lobes, two whereof (which being the leſs) are forwardly, and two (which are much bigger) backwardly.

Theſe Diviſions appear beſt in the inverted or *Varolian* Diſſection, being marked out as it were by four Branches of the Carotid Artery, two before, and one on each ſide.

Theſe I call *Imperfect Diviſions of the Brain*, becauſe though the *Pia Mater* runs betwixt them, together with the aforeſaid Branches of the great Artery, yet they adhere by ſeveral Fibres, both of that Membrane and the Blood-veſſels themſelves.

'Tis alſo imperfectly divided thro' all its external cortical part by the *Pia Mater*, though not ſo profoundly, to the end the Blood-veſſels may penetrate this part in more fine and reticular Ramifications; and that by the

the pulsation of the Arteries the interjacent cortical Glands, (or rather Vessels) may more freely make their proper Secretions.

Nextly, it may be consider'd in its inward appearance, which is concave and medullary, taking its original from the Extremities or *Apices* of the *Medulla Oblongata;* (or rather a little more forwardly from the foremost part of *Vieussenius*'s oval Center) commonly called *Processus Lentiformes*, or according to Dr. *Willis*, *Corpora Striata.*

From hence 'tis presently reflected back on each side in the form of a Vault, very near as far as the *Nates* and *Testes*, a little below which on each side 'tis joyn'd with the *Crura Medulla Oblongata* on their under side, being continuous there to those Parts commonly call'd the *Crura Fornicis.*

The middle and uppermost part of this Medullary Substance, by the Ancients always called *Corpus Callosum*, is therefore by *Vieussenius* called *Fornix Vera*, in his Opinion sustaining that Office (though I see not that it does, or for the Reasons Vieuss. p 51 par. 1.

before given in the deſcription of the *Dura Mater* and its Proceſſes, needs to do any ſuch thing.)

This is that part which, as was before noted, was thought (but miſtakenly) by *Veſalius* and others to eſcape the covering of the *Pia Mater* and in it are not viſible any bloody Specks, as in moſt other parts of the *Medulla Cerebri*.

'Tis the *medium* uniting the medullary part of each Hemiſphere or Diviſion of the Brain, famous for the tranſverſe *Stria* running through it from each ſide of the aforeſaid Hemiſpheres, the *Septum Lucidum* only coming between.

In this large or principal Cavity are contained the three *Ventricles*, the *Fornix*, the *Septum Lucidum*, *Corpora Striata*, *Thalami Nervorum Opticorum*, the *Roots of the Fornix*, the *Tractus Intermedius* of the *Corpora Striata*, the *Tractus Medullaris Thalamis Nervorum Opticorum Interjectus*, (which laſt has bin already deſcribed) the *Vulva*, *Anus*, and *Rima* or Paſſage to the *Glandula Pituitaria* by the *Infundibulum*, and *Glandula Pinealis*, (which alſo hath already been deſcribed) of all which briefly in their order.

The

Fig 5. AA The three Ventricles, by cutting asunder the *Fornix* near to its Roots, and turning it backwards over the *Nates*, *Testes*, and *Glandula Pinealis*, appear to be but one, those on each side it being called the *Laterales*, in which are the *Corpora Striata Thalami Nervorum Opticorum* and *Crura Medulla Oblongata*, that *Rima*, so far as 'tis covered with the *Fornix* and parts the *Crura Medulla Oblongata*, being the third.

The three Ventricles.

From the extream Limits of these two side Ventricles, from before to behind, does arise that medullary space called by *Vieussenius*, *Centrum Ovale*, in his Opinion the great Dispensatory of Animal Spirits, the fore part whereof *Willis* calls *Limbus anterior corporis striati.*

Vieuss. T. 10 AA, &c.

Centrum Ovale.

Will. de An. Brut. p. 42. T. 8. E

The Fornix. Fig. 5. AA, bb. The *Fornix* is a medullary part arising from two Roots in the foremost part of the *Basis* of the *Brain*, lying betwixt and upon the uppermost parts of the *Thalami Nervorum Opticorum*, which Roots come out of the foremost part of the *Geminum Centrum semicirculari*, so called by *Vieussenius*, like two large

Nerves, and afterwards joyn together, conſtituting a broadiſh medullary Body, which after having firſt projected it ſelf for ſome ſpace forwardly betwixt the *Corpora Striata*, and afterwards run the length of the third Ventricle, growing all the way broader and broader, and towards its edges (by *Vieuſſenius* called *Fimbræ*) thinner; and being reflected backward towards the hinder part of the lateral Ventricles, like two Arms, commonly called *Crura Fornicis*, the beginnings whereof on each ſide are by *Aurantius* called *Hippocampi* and *Bombyces*, (from whence, I know, he had chiefly obſerv'd this part in Brutes, in which, by vertue of the hinder part of the *Fornix*, in that place growing ſomewhat thicker, and running over the hinder and upper parts of the *Th. Nerv. Opticorum*, which are more prominent in them, as in *Sheep*, *Calves*, *&c.* than in Men) it is made to appear on each ſide like the bending Creſt of the *Sea-horſe*, and is in colour much like the *Silk-worm*. certain minute *Stria's*, which *Malpighius* calls *Fibræ*, croſſing them like Rings obliquely, contrary to what the ſame Au-

Vieuſſen. Tab. 6. D

Aurant. Anat. p. 45.

Malp. de Cereb. p. 5

Author's Account is of them, who says those *Fibræ* or *Striæ* run upon them otherwise, *viz.* as they do on the *Septum Lucidum* (*i. e.* longitudinally) and embracing the *Th. Ner. Opt.* on their upper part on both sides, but adhering close to them as one continued Substance on their under part, (in which place they are called, by *Vieussenius*, *Posteriores veri fornicis* (viz. *Corporis Calloſi*) *Columnæ*) becomes there continuous with the hinder part of the *Corpus Calloſum*, where it winds down upon the sides of the *Crura Medulla Oblongata*, and makes up that undermost space or cavity of the two side Ventricles, by the said *Aurantius* called *Ventriculi Hippocampi* or *Bombycini*, and *Vieussenius* called the hinder part of the *Centrum Ovale*, which by that kind of curved passage loses something of its oval figure.

Vieuſſ. p 61.

Ibid.

Tot Septum Lucidum.

The *Septum Lucidum* some of the Moderns think to arise from the *Fornix*, thence ascending to the internal Superficies of the *Corpus Calloſum*; others from this last descending down to the *Fornix*, but most

likely from this laſt, where towards its foremoſt part I have always found it double, (firſt taken notice of by *Sylvius de le Boe*) and as *Vieuſſenius* truly ſays, often with Water in its duplicature. Sylv. de le Boe *Diſp. Med.* p. 19. par. 1. Theſ. 13.

'Tis a very thin, medullary, tranſparent Body, intermediate to the *Corpus Calloſum* and ſubjacent *Fornix*, by means whereof the two lateral Ventricles are in that place ſeparated one from another.

The Corpora Striata, Fig. 5. I I, *&c.*

The *Corpora Striata*, or *Proceſſus Lentiformes*, are two Prominencies ſituated ſomething higher than, and in Men a great part of them on each ſide (though Dr. *Willis* ſays, where the *Corpora Striata* ends the *Thalami Nervorum Opticorum* begins, which is only ſo in Brutes) of the *Thalami Nervorum Opticorum*, or *Juga Crurum Medullæ Oblongatæ*, and are ſo called from the many white Streaks appearing in them, deſcending obliquely to the *Medulla Oblongata*, with Cineritious Subſtance coming betwixt them when they are cut horizontally.

They

They run down on each ſide the *Thalami Nervorum Opticorum* as far as till the *Corpus Calloſum* begins to wind back upon the *Crura Medulla Oblongata*, towards the hindermoſt part thereof.

I have got them delineated here exactly true, (tho' by neglect without the *Striæ*) finding all the Cuts of them in *Willis* to be from Brutes, except one, which is done very ill, and thoſe in *Vieuſſenius* very falſe, unleſs in Figure the 8th, which alſo wants the *Striæ*.

The Thalami Nervorum Opticorum.

The *Thalami Nervorum Opticorum* are two prominent Bodies, more purely medullary on their outward Superficies than within, which meeting together like the two topmoſt ſtroaks of a Y inverted, conſtitute the uppermoſt part only of the *Crura Medulla Oblongata* in that form, the other or undermoſt ſide being quite of another figure; and ſeeing they are the immediate continued Productions of the *Medulla Globoſa Cerebri*, (which contrary to the old Opinion of *Praxagoras* and *Philotimus*, aſſerting the Brain to be only a *Germination*

mination of the *Dorſal Marrow*, of late reviv'd by *Bartholine*, (if any precedency of Parts as to time may be allow'd) I look upon to be rather the original than the production of the *Medulla Oblongata* and *Spinalis* too) and may more properly be called *Capita* than *Crura* of the *Medulla Oblongata*. *Cauſab. In Athan. p. 137.*

FIG. 5. cc. The Tops or *Juga* do, as already obſerved, encline cloſe, yea, joyn together, as *Vieuſſenius* hath rightly obſerved contrary to *Willis*, (whoſe Figures of that part are utterly falſe) unleſs where the *Rima ad Infundibulum* parts them, leaving like the *Corpora Striata* an obtuſe angle between them.

Betwixt theſe two laſt mention'd Bodies there is a medullary ſpace on each ſide, which in a bending manner encompaſſes the *Thalami* themſelves, and receive the Extremities of the *Striæ* in the *Corpora Striata*, as they deſcend from the aforemention'd *Centrum Ovale*, and is therefore by *Vieuſſenius* called *Geminum Centrum Semicirculare*, by *Willis* *Limbi Poſteriores Corporum Striatorum* *Vieuſ. p. 67. par. 2. Willis de An. Brut. p. 42. T. 8. fi.*

The

The reaſon why they are called *Thalami Nervorum Opticorum*, is from certain Fibres ſuppoſed to be in them, ariſing both from their true medullary Superficies (by *Vieuſſenius* call'd a *Medullary Membrane*) and ſome from within their own Subſtance, which at laſt, towards their foremoſt part meeting together, make up the Bodies of the *Optick* Nerves.

Willis ſays nothing of theſe Fibres, though in his Opinion *Galen* did not improperly give them that name. *Vieuſſenius* paints them very ſtrong.

As for my part, I never could find any Fibres at all appearing in their external medullary part, thoſe within are very ſmall at beſt, and ſcarce diſcernable.

A Medullary Tract. Tab. 5. mm

On the outſide of theſe I have always found and often ſhowed a very fair medullary Tract, here deſcribed, running all-along betwixt the *Corpora Striata*, & from the very hindermoſt extent of the *Corpora Striata* forwardly, down to the very Roots of the *Fornix*, to which they ſeem to be continuous.

With-

The Passage into the Infundibulum

Within this Cavity of the Brain are likewise two passages into the *Infundibulum*, and so on to the *Glandula Pituitaria*, the foremost of which is called by the odd Name of *Vulva*, and the hindermost of *Anus*, from their situation, which with the *Rima* betwixt them, is called, as was before noted, the *third Ventricle*.

The Vulva.

The Anus.

Tria Foramina.

The places whence all this Water issues are commonly by the latter Anatomists described under the name of *Tria Foramina*, situated so as to give passage from all the eminent Regions of the Brain, from whence there can be access had to them for the Water (or rather the *Lympha*, properly so called) to fall into the aforesaid *Infundibulum*, the first whereof is behind the *Testes*, under the *Valvula major*, (hereafter to be described) the other just under the *Pineal Gland*, or the beginning of the *Rima*, which two meet in an Aperture, under the *Nates* and *Testes*, by *Vieussenius* call'd *Aquæ Emissarium*, having a steep descent into the *Infundibulum*; and the last at the end of the *Rima*,

Vieuss. p. 73. par. 3.

Rima, or just under the Roots of the *Fornix*, and all ending at length (tho' by two different passages) in the *Infundibulum*.

The Nates *and* Testes Tab. 7. CC

It may not be unseasonable in the next place to take notice of two remarkable very fair Processes, called *Nates* and *Testes*, by former Anatomists so named from the resemblance they had to those parts; but it is plain from thence they were only used to dissect Brutes, in which they have such a proportion as is betwixt them; whereas in Men 'tis plain they are very near of the same size, and not very different in form, being oblong and accuminated towards their Extremities; but in *Sheep*, *Calves*, and most other Creatures the *Nates* are round and large, and the *Testes* oblong, somewhat accuminated, and very small.

Before these Natiform Processes, under the *Glandula Pinealis*, runs a transverse Process before taken notice of Pag. 84, by *Vieussenius* called *Processus Natibus Antepositus*, and *Nervuli Æmulus*, which upon further enquiry, by drawing the *Thala-* *Vieussen.* Tab. 8. f

mi

mi Nervorum Opticorum ſtill wider, appears to be rather *Nervi* than *Nervuli Æmulus*, being as thick as that behind the Roots of the *Fornix*, to which in ſituation 'tis juſt oppoſite, and ſeems to joyn the *Thalami Nervorum Opticorum* together, as that does the *Corpora Striata*.

In what rank to place them 'tis hard to ſay, as being neither proper Appendices to either the Brain or *Cerebellum*, properly ſo called, and being divided from the *Medulla Oblongata* in ſome meaſure by an Interſtice commonly called *Ductus ad Infundibulum* by the Moderns, but by the Ancients a Paſſage for the Animal Spirits to the fourth or noble Ventricle.

The Iſthmus. They are ſituated upon that part of the *Medulla Oblongata* which is between the *Cerebrum* and *Cerebellum*, which ſpace was before called *Iſthmus*, oppoſite to that part called from its Author *Pons Varolii*, and by many Authors, as *Bartholine*, *Spigelius*, *Highmore*, *&c.* thought to be the two hindermoſt Roots of the *Spinalis Medulla*, which much more likely *Riolanus* makes the Proceſſes of the

Ce-

Cerebellum to be, and with him the great *Veſalius*, who paints them ſo. *Veſalius* p. 766, 767. fig. 10. AA, I, K. & fig. 11. GG.

From this intermediate ſituation Dr. *Willis* thought fit to make them as it were an *Intelligence Office* betwixt the *Cerebrum* and *Cerebellum*, how rightly, I refer to the Judgment of others.

'Tis certain they are medullary Bodies, and contribute to the making the Animal Fluid or Spirits ſo called after the ſame manner as the reſt of the Brain does; for in cutting them through, (after having taken the reticular expanſion of Blood-veſſels off from them, which is very large here, and eminently conſpicuous in injected Brains) I find them of the very ſame ſubſtance with the *Proceſſus Annularis* and the *Thalami Nervorum optici*, partly cineritious, and partly medullary, and in freſh Brains ſomewhat, but very faintly, ſtriated.

I know not of any part within the Brain, properly ſo called, that is not already deſcribed, except a certain *Medullary Chord* at the end of the third Ventricle, and the *Valvula major*.

The

Commissura Crassioris Nervi Æmula of Vieussenius.

The first of these is a Medullary Process, which joyns the *Corpora Striata* together, according to Dr. *Willis*, by *Vieussenius* called *Commissura Crassioris Nervi æmula*; and according to him is the *Medium* or *Commissura* by which his *Geminum centrum semicirculare* intervening between the two *Corpora Striata superiora anteriora & posteriora*, and his *Tractus medullaris transversus & obliquus* intervening between his two *Corpora Striata inferiora anteriora* and *posteriora*, have a communication with each other. *Willis* p.43 col. 2. *Vieuss* p.83.

Dr. *Willis* places this *Chord* or *Commissure* under the Roots of the *Fornix*, but it is always behind it, tho' contiguous to it. *Willis*, p.6. col. 1.

The Valvula major.

The second is the *Valvula major*, so called by *Vieussenius*, but plainly enough discovered by Dr. *Willis* long before, and its proper use described. *Vieuss.* p.76. *Willis*, p.49 col. 2. par. 2

It is a thick (especially in Men) medullary Membrane, adhering forwardly to the inferiour part of the *Testiforme Proceß*, a little behind that transverse medullary Process from whence the pathetick

tick or fourth Pair of Nerves ariſe, laterally to the Proceſs aſcending from the *Nates* to the *Cerebellum*, on its hindermoſt Expanſion, to the foremoſt *Vermicular* Proceſs of the *Cerebellum*, and no where that I know of to any part of the *Pons Varolii*, as *Vieuſſenius* will have it, (who ſeems to have miſtaken another part for that Proceſs) unleſs juſt where the ſecond Proceſs of the *Cerebellum* comes out from thence, which jointly with its fellow Proceſs on the other ſide, when they meet together, after their tranſverſe deſcent on the back-part of the *Medulla oblongata*, do really make up that part which by *Willis* is call'd (and that no doubt from *Varolius*) *Protuberantia Annularis*, and by others, from its true Author, *Pons Varolii*.

Vieuſſen. p. 76. *Id.* p. 73. par. 3.

By raiſing up the foremoſt above-mention'd Vermicular Proceſs of the *Cerebellum* with the Finger, it rarely fails to come in ſight; but if not ſo, 'tis eaſily ſhown, by blowing into the *Foramen* ſituated under the Pineal Gland.

Its uſe, according to *Vieuſſenius*, is to hinder any part of that Water which falls into the hindermoſt *Fo-*

Vieuſ. p. 110 par. 2.

ramen behind the *Teſtes*, from running into the fourth Ventricle, or *Vice verſa* from the fourth Ventricle into it, or from getting out on each ſide of the *Medulla oblongata*, over the afore-mention'd Proceſſes, ſo as to fall down upon the Nerves ariſing thereabouts below from the *Medulla oblongata*: Which laſt uſe is evidently moſt true, (whether it be underſtood of Water preternaturally or accidentally collected there, for I muſt needs confeſs I could never find any there, any more than I could in the third Ventricle in Subjects free from thoſe Diſeaſes incident to that part, as hath before already been remarked *p.*82.)but as to that relating to the paſſage from the *Cerebellum* to the laſt or third *Foramen*, I much doubt the Truth of it, for many Reaſons, of which this is one, *viz.*

That the *Plexus Choroeides* in the fourth Ventricle, together with the adjacent Parts, being of the ſame Texture as the other are in and about the two lateral ones of the Brain, renders it as reaſonable to ſuppoſe that Water may be collected there as in other parts of the Brain, (nay, that it is ſo, he himſelf alſo allows as Matter of Fact) and conſequently as neceſſary

ceſſary to have a place of vent for the Water whenever it happens to gather there, as it was for that which was at any time got into the other Ventricles. And conſequently,

In the next place, I do not ſee how this tender Film can be able to intercept a paſſage of ſo ſearching a body as Water at any time forced againſt it (notwithſtanding the ſuppoſed declivity of this Part, which in Man, by reaſon of the largeneſs of the ſubjacent prominent annular Proceſs, is very inconſiderable) which by Pulſation muſt needs happen whenever we ſuppoſe that Cavity filled with it.

And, in the laſt place, notwithſtanding all the Contrivance the aforeſaid Author hath ſhewn in conveying the groſs part of the Water (which, as was before noted, he grants may be, nay, conſtantly is depoſed there from the Glands of the *Plexus Choroeides* here ſituate) by the Extremities of Veins, out of this Ventricle, I am ſuſpicious, if there was no ſpedier reductory paſſage found out, there would frequently happen very great Miſchiefs to the *Medulla Spinalis* it ſelf, and the Nerves ſpringing from it, ſeeing the Extremity of that Ventricle called the *Calamus Scriptorius* is there *Vieuſ. p. 111*

parted from the Spinal Marrow behind it, but only by the *Pia Mater*, which notwithſtanding it is there double, as it is alſo quite down the whole *Spine*, leſt perhaps the Water ſhould fall down upon the Nerves which ariſe from it too readily, yet upon ſuch an occaſion may be eaſily ſuppos'd ſubject to violation. Not to ſay any thing of the high improbability of any ſuch Conveyance at all by the Veins, ſeeing that in a natural ſtate they are always, as hath been already obſerv'd, continuations only of Arteries.

'Tis true, this may hinder the fall of Water into the fourth Ventricle, by reaſon of a Paſſage under the *Nates* before mention'd, by *Vienſſenius* call'd *Aquæ Emiſſarium*, ſo near at hand to receive it when it finds its further paſſage that way obſtructed by the interpoſition and reſiſtance of this Valve. And for the ſame reaſon doubtleſs it was, that in *Vieuſſenius's* Experiment which he brings for a Proof of his Opinion, no Water was found in the fourth Ventricle, it having got a paſſage immediately, upon its non-admittance by that Valve, to convey it another way, which by reaſon of the ſteepneſs thereof, is done much more readily. *Vieuſ.* p. 110 par. 2.

CHAP.

CHAP. XIV.

Of the Cerebellum.

THE *Cerebellum* falls next in order to our conſideration, in deſcribing of which I hope a great deal of pains may reaſonably be ſpared, ſeeing all that hath been already ſpoken of the cortical or cineritious part of the Brain, as alſo of its medullary part, is equally applicable to the *Cerebellum*. Nor is what hath been ſaid already of the *Plexus Choroeides* in the Ventricles of the one part leſs applicable to that *Plexus* in this.

The Plexus Choroeides of the Cerebellum.

This *Plexus Choroeides* in the fourth Ventricle begins to be glandulous juſt under the Eighth Pair of Nerves, from whence it runs up on the ſide of the *Caudex Medullaris* to the chordal or third Proceſs of the *Cerebellum*, and from it enters the fourth Ventricle, by *Aurantius* called *Ciſterna* Aurant. *Anatom. Obſ.* p. 48.

Ciſterna Spirituum, (which Ventricle, conformably to what that Author hath in the aforeſaid place obſerved, I always find broader than long, and double, though not divided by any intervening Body, as the two lateral ones of the Brain are;) not lying looſe therein, nor at the bottom of it, as the *Plexus* does in the Ventricles of the Brain, but quite contrariwiſe, (and which hath not heretofore, as I know of, been taken notice of) adhering cloſe to the top of this Ventricle, or the bottom of the ſuperincumbent *Cerebellum*, then running tranſverſe juſt at the end of the *Calamus Scriptorius*, there becomes continuous to the *Plexus* of the other ſide; as hath been obſerv'd of the *Plexus* in the lateral Ventricles of the Brain.

This *Plexus* ariſes from a ramification of the ſecond or backwardeſt Branch of the Cervical Artery, as one part of the other *Plexus* of the Brain mention'd in that Chapter where the ſaid *Plexus* is treated of, doth) and another ſmaller Branch of the ſaid Artery about the place where it aſcends from the Vertebrals,

Fig. 1. 9 brals, which laſt Branch turns into a reticular Expanſion firſt, and then a little ſpace further meeting with the other, conſtitutes this *Plexus*.

This part differs from the Brain in its cortical ſtructure, inaſmuch as its Interſtices are here eliptical or pieces of imperfect Circles, growing ſhorter towards thoſe two Productions of the *Cerebellum*, before and behind, (which by reaſon of certain annular depreſſions occaſion'd by Bloodveſſels there embracing them, ſeem as tho' they were wrinkled like Worms, and therefore called *Proceſſus Vermiculares*) as Parallels upon the Globe do towards each Pole.

The three Proceſſes of the Cerebellum. It hath three Proceſſes, which joyned together on each ſide, make up as it were two fair Roots, according to the Ancients called the hinder Roots of the *Oblongata Medulla*, by the Moderns *Peduncles* or *Stalks*, by which this part grows to the *Medulla Oblongata*.

Fig. 7. gg The firſt of theſe aſcend from the *Cerebellum* to the *Nates*, the ſe-

Fig. 6. BB. cond from the *Cerebellum* to the *Medulla Oblongata*, which meeting together on the under ſide thereof,

as was before noted, make up that large Protuberance by *Willis* called *Proceſſus Annularis*, by others from the firſt Author *Pons Varolii*.

Var. Anat. p. 26.

This I find full of *Stria's* or medullary Tracts, much ſtronger and larger than thoſe of the *Corpora Striata*, running tranſverſe on each ſide the length of the whole Proceſs, and terminating in a medullary long Tract, dividing that Proceſs into two equal parts, as you ſee in the Figure, the uſe whereof, as having never been before obſerved, will be hereafter taken notice of.

Fig. 6. cc

Ib. c c

The third deſcends from this part backwards, upon the upper ſide of the *Medulla Oblongata*, like two longiſh thick Chords on each ſide, making the *Medulla* look ſomewhat thicker and broader in that place, and not unfitly ſtiled the *Chordal Proceſs*.

Ib. f f

Fig. 7. hh

Theſe *Stalks*, when they joyn together at the other end, make up the *Meditallium* or *Corpus Calloſum* of the *Cerebellum*.

The tranſverſe Proceſs of the fourth Ventricle.

There are two or three fair medullary Proceſſes cloſe to, and ſometimes

ri-

riding one over another, a little on this ſide the fourth Ventricle, or about the beginning of the *Calamus Scriptorius*, which joyn the two ceſſes together that deſcend from the *Cerebellum* to the *Medulla Oblongata*; and there are two more deſcending length-way from that other tranſverſe Proceſs behind the *Teſtes*, down to theſe.

New Proceſſes on the inſide of the Medulla Oblongata.

Theſe long medullary Proceſſes I never find wanting, though in different numbers, ſometimes having ſeen three, ſometimes two, and once I could find but one, (though larger than ordinary) and conſtantly, in what number ſoever, ending in the tranſverſe Proceſſes at the afore-mention'd beginning of the fourth Ventricle.

Theſe long deſcending Proceſſes are juſt over-againſt the *Corpora Pyramidalia*, on the other or under ſide of the *Medulla Oblongata*, and the tranſverſe Proceſſes at the beginning of the fourth Ventricle laſt mentioned, are a little above the original of the Eighth Pair of Nerves, inſomuch that without being very circumſpect one may

may miſtake them for the original of that Nerve, whereas in reality I find them to be the original of the ſoft or hindermoſt Branch of the Seventh, as will be more particularly taken notice of hereafter, in the deſcription of thoſe Nerves; and therefore cannot but wonder how Dr. *Willis* (who ſpeaks in one place as though he had ſeen them) came to aſſign them for the Root of the ninth Pair, beneath which and this Proceſs I have always obſerved the ſpace of half an inch.

Willis Cerib. Anat. p. 12. col. 2. par. 3.

CHAP.

CHAP. XV.

Of the Medulla Oblongata.

THE third part of the Brain, in its general acceptation, according to the foregoing method, is called the *Medulla Oblongata*, all whoſe parts on its foreſide having already been ſpoken of, it remains in the next place that we take notice of it on its other ſide, where are moſt conſiderable its *Crura*, ſo called, which *Crura* are only the under part of the *Thalami Nervorum Opticorum* before deſcribed, which in their Extremities becoming continuous to the under ſide of the medullary hinder part of the Brain, occaſion'd the Ancients to think the *Medulla Oblongata* had its foremoſt Roots immediately from the Brain there, as it had its hindermoſt from the Proceſſes of the *Cerebellum*; but upon a more diligent enquiry it appears, that theſe

Crura Medulla Oblongata.

Crura

Crura are more deeply immerged in and knit to the *Medulla Globosa* of the Brain forwardly, by vertue of the *Corpora Striata*, as also by the very medullary part of the Brain it self, which there, from the back or undermost winding part of the *Corpus Callosum* is perfectly mingled with it.

Where these two *Crura* begin to come close together, the *Protuberantia Annularis*, or *Pons Varolii*, made up of the second Process of the *Cerebellum* aforemention'd, begins to cover the *Medulla Oblongata* for about the space of an inch and an half, after which this *Medulla Oblongata* in one large Trunk is continued to the first *Vertebra* of the *Spine*, and so quite down to the end thereof.

Fig 6. BB

The two white Bodies behind the Infundibulum. Fig. 1. bb

Whilst the *Brain* is in this position it may not be unseasonable to take notice of two fair white Bodies on this side of the *Infundibulum*, in that depressed part of the Brain, where the *Pia Mater* (as hath before been taken notice of) is so remarkably double.

There

The Corpora Pyramidalia. FIG. I. n.

There are alſo two white long medullary Proceſſes called *Corpora Pyramidalia* both by *Willis* and *Vieuſſenius*, which ariſe juſt at the ending of the Annular Proceſs running down upon the *Med. Oblongata* the ſpace of an inch, ending a good ſpace below the place where the Eighth Pair of Nerves begin, which have their original between the *Corpora Olivaria* and the *Chordal Proceſſes* partly on the other ſide thereof, contrary to the account we have of them by Dr. *Willis*, who deſcribes them as ending in pointed Extremities, juſt where *thoſe Nerves* have their original. *Willis*, p. 13. col. 1. par. 1 p. 61. col. 2. par. 3.

The Corpora Olivaria. Ibid. o.

On each ſide of theſe appear plainly the *Corpora Olivaria*, ſo called from their Figure, as the former were by *Vieuſſenius*, which with the *Corpora Pyramidalia* and two white Bodies behind the *Infundibulum*, he calls *Conceptacula Spirituum Animalium*, or places containing Animal Spirits upon ſeveral occaſions of uſe to the Brain, both in its natural and intellectual Faculties.

CHAP.

CHAP. XVI.

Of the Nerves.

IN the ſame poſition of the Brain we alſo have a fit time of taking a view of the Nerves, which are ſtill medullary Productions of the Brain diſperſed to all the parts of the Body, which have need of either Senſe or Motion, and theſe are in number ten Pairs or Conjugations, having their Names and Originals as follows.

The firſt is the *Olfactory Pair*, which after they leave the former Lobes of the Brain, and begin to run to the Bone called *Ethmoides*, take the name of *Proceſſus Mammillares*; but this is chiefly in Brutes, where through their largeneſs they have that appearance, and are manifeſtly hollow.

By the utmoſt Scrutiny I have been able to make, they have but one Original, and that is from the undermoſt and foremoſt part of the

Crura

Crura Medulla Oblongata, where they advance on each ſide into the Globous medullary part of the Brain, from whence running concealed betwixt its foremoſt and hinder Lobes obliquely, for a good ſpace, at laſt they come in ſight, as you ſee them in the Figure: And by what means *Vieuſſenius* comes to find ſuch diffuſed Originals for them as he ſpeaks of, I know not.

Their Uſe is known to moſt, and a particular account thereof, as of the reſt, together with the manner of Senſation, with relation to the external Organs of Senſe, is much more fit for a Phyſiological Tract than one of this kind.

I ſhall therefore only at this time give a general deſcription of the Nerves belonging to the Brain, how and where they ariſe, the difference or variety whereof ſerve very well to inform us, according to ſeveral late Theories, concerning the different Reſervatories of the Animal Fluid or Spirits, and the different diſpenſation of the ſame to ſeveral parts of the Body.

The

The Second Pair. Ibid. n 2. The ſecond Pair are called the Optick or Seeing Nerves, of which I find no more Originals than of the former, and that is from thoſe medullary parts called *Thalami Nervorum Opticorum*, tho' *Vieuſſenius* ſays they are from ſeveral parts; and *Willis* in general terms from the aforeſaid *Thalami Nervorum Opticorum*, behind the *Corpora Striata*: which deſcription is more exact in *Quadrupeds*, where the *Thalami Nervorum Opticorum* are altogether in ſituation behind the *Corpora Striata*, than in Men, where a great part of the *Corpora Striata* are ſituated on the outſides of the *Thalami Nervorum Opticorum*, and only their Heads or Extremities before them.

The Blood-veſſels mention'd both by *Willis* and *Vieuſſenius* belonging to theſe Nerves, I have ſeen to run not only upon or with them, but alſo in injected Bodies exactly quite thro' the medullary ſubſtance of them, into the reticular Coat of the Eye, wherein they end in an infinite number of the moſt capillary Ramifications, which by an injection of that Artery made

made with Mercury, become very delightfully conſpicuous to the Eye.

The Nervous Fibres alſo, from the fifth and third Pair of Nerves, do twine about the Bodies of theſe Nerves, as the two above-mention'd Authors do truly affirm, but how rightly they both aſſign to them the office of dilating and contracting them ſubſerviently to the viſory faculty, and preternaturally in Convulſions of the Eye, as though theſe Fibres were truly Muſcles, or of the carnous kind, I refer to the Judgment of others.

Theſe go out of the Skull at its firſt *Foramen*.

The Third Pair. Fig. 1 ſt 33 The third Pair ariſe out of the forward and upper part of the Annular Proceſs, where 'tis contiguous to, and covered with the under part of the *Thalami Nervorum Opticorum*, coming out into ſight from between them, juſt where that Proceſs terminates forwardly, which is where the *Crura Medulla Oblongata* come together into one body, conſtituting the *Caudex Medullæ Oblongatæ*.

The Second Pair. Ibid. 2 2. The ſecond Pair are called the Optick or Seeing Nerves, of which I find no more Originals than of the former, and that is from thoſe medullary parts called *Thalami Nervorum Opticorum*, tho' *Vieuſſenius* ſays they are from ſeveral parts; and *Willis* in general terms from the aforeſaid *Thalami Nervorum Opticorum*, behind the *Corpora Striata*: which deſcription is more exact in *Quadrupeds*, where the *Thalami Nervorum Opticorum* are altogether in ſituation behind the *Corpora Striata*, than in Men, where a great part of the *Corpora Striata* are ſituated on the outſides of the *Thalami Nervorum Opticorum*, and only their Heads or Extremities before them.

The Blood-veſſels mention'd both by *Willis* and *Vieuſſenius* belonging to theſe Nerves, I have ſeen to run not only upon or with them, but alſo in injected Bodies exactly quite thro' the medullary ſubſtance of them, into the reticular Coat of the Eye, wherein they end in an infinite number of the moſt capillary Ramifications, which by an injection of that Artery made

made with Mercury, become very delightfully conſpicuous to the Eye.

The Nervous Fibres alſo, from the fifth and third Pair of Nerves, do twine about the Bodies of theſe Nerves, as the two above-mention'd Authors do truly affirm, but how rightly they both aſſign to them the office of dilating and contracting them ſubſerviently to the viſory faculty, and preternaturally in Convulſions of the Eye, as though theſe Fibres were truly Muſcles, or of the carnous kind, I refer to the Judgment of others.

Theſe go out of the Skull at its firſt *Foramen*.

The Third Pair. Fig. I. ß 33 The third Pair ariſe out of the forward and upper part of the Annular Proceſs, where 'tis contiguous to, and covered with the under part of the *Thalami Nervorum Opticorum*, coming out into ſight from between them, juſt where that Proceſs terminates forwardly, which is where the *Crura Medulla Oblongata* come together into one body, conſtituting the *Caudex Medullæ Oblongatæ*.

These running through a duplicature of the *Dura Mater*, on the outside of the *Circular Sinus*, go out of the second hole of the Skull to the Eyes, and are therefore called *Par Oculorum Motorium*, to the voluntary motion of which only they are granted to be subservient, which, seeing they have their original from the *Cerebellum*, afford us no weak Argument against the Hypothesis of Dr. *Willis*, who hath reserv'd that part in Nerves subservient to involuntary motions only.

The Fourth Pair. Ibid. 44. The fourth Pair is very small, coming from the transverse Process on the foreside of the *Medulla Oblongata* behind the *Testes*, first coming in sight between the undermost part of the hinder Lobe of the Brain and the *Cerebellum* laterally, crossing that part where the Annular Process ends towards the *Crura Medulla Oblongata*, from whence they pass into a duplicature of the *Dura Mater*, and afterwards, a little more outwardly than the former, goes through the same second hole to the *Trochlear* Muscle of the Eye, and are called from their mo-

moving of that according to the paſſions of the Mind, the Pathetick Pair.

The Fifth Pair. Tabl. 5 5.

The fifth Pair is broad and large, made up of many thick Fibres continuous to each other, ſome ſofter than others, ariſing from the uppermoſt part of the *Proceſſus Annularis*, which is backward laterally, where 'tis broadeſt, by reaſon of the ſecond Proceſs of the *Cerebellum* there entering it.

The ſeveral Branches of the fifth Pair.

This Nerve, after having firſt climb'd over the inner Proceſs of the *Os Petroſum* into a kind of a Cavity made of a duplicature of the *Dura Mater* in that place, immediately ſwells into a kind of a thickneſs, called a *Ganglion*, from whence ſeveral Branches are propagated, lying betwixt the *Dura Mater* and the *Cranium*, on each ſide the *Sella Turcica*, without any *Fovea* or Cavity at all, going out of the Skull at three ſeveral places, its ſuperiour ſmall Branch at the ſecond hole with the third and fourth Pair of Nerves, its inferiour ſmaller Branch at the third hole, and its poſteriour or largeſt Branch at the fifth.

Fig. 3. B

Fig. 3. C, D, E

Fig. 2. y. From the inſide of the foremoſt Branch two little ones turn back, and meeting with another ſmall Branch a little lower turned back alſo from the ſixth Pair, where that Nerve is faſten'd to the outmoſt or borrowed Coat of the Carotid Artery, make up a ſmall Trunk of a reddiſh or fleſhy colour, like to that which 'tis of when paſſed out of the *Cranium*, (as *Veſlingius* hath truly obſerved, who calls it *The Internal Branch of the Sixth pair*) which deſcending obliquely, and creeping under that Artery, betwixt its external, proper, and borrowed Coat, goes out with the Carotid Artery at the fourth hole of the Skull, which is in a manner double between the *Os Petroſum* and *Cuneiforme*, and from its paſſage through the *Thorax*, near the Roots of the Ribs, (all-along which, it receives a Branch from the Intercoſtal Nerves) is call'd, *The Intercoſtal Pair.*

The Intercoſtal Pair. X. z z.

The ſixth Pair. Fig. 1ſt. 6 5. The ſixth are about the bigneſs of the third, ariſing from the hinder part of the Annular Proceſs over-againſt, and not far off from the beginning or head of the *Corpora* Py-

Pyramidalia. It ſends out ſometimes one (in this Subject very ſhort) ſometimes two ſlips, as was afore ſaid, for the making up the Trunk of the Intercoſtal Nerve, and after that (with the foremoſt Branch of the fifth Pair, in one and the ſame duplicature of the *Dura Mater*, together with the preceding third and fourth Pair of Nerves) goes out at the ſecond hole of the Skull, and terminates in the abductory Muſcles of the Eye.

The ſeventh Pair. Fig. 1ſt, 77.

The ſeventh Pair, or Hearing Nerve is large, and comes out almoſt juſt over-againſt the original of the fifth Pair, on the lower or under ſide of the ſecond Proceſs of the *Cerebellum*, where it firſt appears coming out from the *Cerebellum* to make the aforeſaid *Protuberantia Annularis* between the *Corpus Olivare* and that Protuberance, as though it crept out betwixt them, and had (as it really hath) a more remote extraction.

It conſiſts of two diſtinct Proceſſes, the firſt of which is more round, hard, and leſs than the ſecond, that being for Motion,

this for Senſe, but tho' they ſeem as though they had the ſame original, being ſeemingly continuous at their riſe from the Brain, (which Dr. *Willis* affirms they have, tho' ſometimes he makes it in one place, and ſometimes in another) yet upon a further enquiry it does appear otherwiſe, the firſt or hardeſt having its original from the *Caudex Medullaris*, not far from the place where it comes firſt in view; the ſecond very remote from the tranſverſe Proceſs or Proceſſes in the paſſage to the fourth Ventricle before deſcribed, (which in another place the ſame Author ſeems plainly to have obſerv'd, taking it for the Original of the other Proceſs of this Nerve;) from whence it aſcends all-along on the ſides of the *Medulla Oblongata* till it arrives at the afore-mention'd place, where it firſt, together with the other Branch, leaves the *Medulla*, to paſs out of it at the ſeventh hole in the Bone called *Petroſum*.

Willis, p. 12 col. 2. par. 3 & p. 56. col. 1. par. 4.

FIG. 7. 11

Willis, p. 78. col. 1. par. 1

The eighth Pair.

FIG. 1. 8 8

The eighth, or *Par Vagum*, ariſes a very little beneath the ſeventh, but yet not from any part of the An-

Annular Protuberance, but exactly in that somewhat hollow place betwixt the *Corpus Olivare* and third or Chordal Process, having numerous (I have counted ten or twelve) Fibres, but all continuous at their first rise, for its original.

This in a multitude of Ramifications is spent upon the Bowels, and goes out at the eighth hole with the Spinal Accessory Nerve, where the great lateral and the inferiour little *Sinus's* in the Basis of the Skull go out into the Internal Jugular.

To this eighth Pair about half an inch from its first rise, whilst it climbs upon or sticks to the *Pia Mater* upon the Basis of the *Cerebellum*, ascends a Nerve called *Spinalis Accessorius* by *Willis*, but long before him taken notice of, nay, painted and described, by *Vidus Vidius*, the original whereof I find to be as far as the seventh Vertebral Pair, from the foremost and hindermost beginnings of that Nerve, notwithstanding *Vieussenius* confines its

Fold. * * *Vidus Vidius*, p. 93. T. 18. Fig. 2. *

original to the fourth Pair of that part only.

This Nerve runs under the Vertebral Artery near half an inch on the ſide of the *Medulla Oblongata*, at length, about half an inch from the beginning of the eighth Pair, leaves the aforeſaid *Medulla Oblongata*, running obliquely upon the *Pia Mater* of the *Cerebellum*, to joyn with the aforeſaid Pair, which it really does in that very place, though it part with it afterwards again.

The ninth Pair. Ibid. 9 9.

The ninth hath ſeveral (in one Body I counted ſeven or eight) pretty large Fibres for its original, very diſtant one from another, the firſt of them coming higher, from the very top of the *Corp. Olivare*; the next, and ſeveral others, are much leſs, a quarter of an inch lower; and the laſt much lower yet, about the ending of the *Corpus Olivare*, or beginning of the tenth Pair, with ſeveral others between the *Pia Mater* and ſubjacent *Medulla Oblongata*; but after all, its Trunk is very little, about the bigneſs of the Acceſſory Pair.

Thro'

Thro' the Fibres of this Nerve there runs commonly a ſmall but very viſible Branch of the Vertebral Artery, at its original; as you ſee in the Figure expreſſed by the Letter *k* on the right ſide, going out at the ninth hole, together with this Nerve and the Vertebral Vein, which Vein *Vieuſſenius* miſtakenly makes to go out at a tenth hole, foraſmuch as that is never found in Nature, neither need be, ſeeing the tenth Pair goes out at the laſt or great *Foramen*, by which the *Medulla Oblongata* paſſes into the *Spine*.

Fig. 1. k.

Vieuſſ. p. 163

The tenth Pair. *Ibid.* 10

The tenth Pair, (which had it a double Original from each ſide of the *Spinal Marrow*, (as all the reſt of the Spinal Nerves have) might much more properly be called the *firſt Vertebral*, inaſmuch as that both a great part of its riſe and egreſs is quite out of the bounds of the *Cranium*) ſerving chiefly the Muſcles of the Neck, it begins with three, and ſometimes more, ſmall Fibres lower a great deal, out of the *Medulla Oblongata*, almoſt an inch below the Trunk of the ninth Pair, and is about the ſize thereof.

It

It goes out of the *Cranium* betwixt the firſt and ſecond *Vertebra* of the Neck, making its paſſage through the *Dura Mater* from the *Medulla Oblongata*, about half an inch below the place where the ſaid Artery comes in.

The Structure of theſe Nerves is conſiſtent of many *Fibrilla's* or *Stria's*, a certain number whereof being firſt encloſed in a production of that delicate inward *Lamina* of the *Pia Mater* afore deſcribed and ſpoken of, makes up a *Faſciculus* or Bundle, and many of theſe collectively the Body of a Nerve.

In theſe *Fibrilla's* or *Stria's* (betubulous and always turgid, as in ſo many Rivulets ſpringing from the main Fountain the Brain, and from thence diſtributed to every reſpective part of the Body) is contain'd the Animal Fluid, by means whereof there is maintain'd a conſtant intercourſe betwixt it and the Soul, and reciprocal acts of Friendſhip betwixt one part and another.

This Animal Fluid I look upon only as a Body conſiſting of very minute and flexile Particles, contain'd

tain'd in ſuch a ſpace as allows them a capacity of being agitated on all ſides by vertue of the ſubtile matter, or Æthereal *Globuli* they ſwim in, by which means they are render'd capable of pervading the narroweſt Channels of the whole Machine, provided its Orifice or Pore be adapt thereto, in contradiſtinction to thoſe other ſort of groſſer Particles of Matter, which by reaſon of the narrowneſs and figure of the ſpace they are to enter, do approximate ſo cloſe, as to become contiguous in all their Superficies, whereby they become deprived of their former expanſive agitation, which is always neceſſary to make a Body fluid, and like ſo many ſmall Filaments orderly diſpoſed, do conſtitute the Incloſures or Coats of thoſe Veſſels the Fluids are contained in.

This Animal Fluid I conceive to be in a continual ſtate of Tranſpiration, proportionable to the meaſure of its leiſurely production, ſeeing no more neceſſity of aſcribing any further Uſes to it, beſides thoſe afore-mention'd, than I do to the

the watery Humour of the Eye, beſides its ſervice to Viſion, which is always in a ſtate of freſh production, as by the Excellent *Nuck's* Experiment is plainly manifeſt; and yet, by vertue of Tranſpiration, ſome way or other, though to us not viſible, without any inconveniency to that noble Organ.

Nuck de Saliv. & Duct. Aqu. Oculor. P. 109.

CHAP.

CHAP. XVII.

Of Senſation *and* Motion *in general.*

THE Nerves thus conſtituted, become accommodated for Uſe in relation to their ſeveral and diſtinct Functions, in ſome conſiſting of Sence only, ſuch as are thoſe appertaining to the particular Senſories, (*viz.*) the Smelling and Seeing Nerves, as alſo the ſoft Proceſs of the Hearing Nerve, ſome Branches of the fifth, and it may be of the ninth Pair, for Taſting; in ſhort, all the Nerves belonging to thoſe external Senſories, by way of eminency, and in a leſs eminent or general way all the Nerves of the whole Body, which are diſtributed to ſuch Parts as by reaſon of their ſtructure are capable of Senſation only, any of which, as furniſh'd with the Nervous Fibrils, but more eminently the *Cuticula*, may properly be call'd an

an Organ or Senſory of *Feeling*; in others of *Motion* chiefly, ſuch as are all the whole Syſtem of Nerves, (excepting them only afore-mention'd) ſes, which though in a leſs eminent manner, are nevertheleſs ſenſitive Nerves alſo: In others of both, in all reſpects (*viz.*) either in a more eminent or leſs eminent Senſation, and Motion too, with relation to the different Fibres they conſiſt of in their Originals, as the fifth and ninth Pairs.

Theſe two different Functions of Senſation and Motion are executed after two as different manners.

The firſt of which, being occaſion'd from external Objects, is diſcharged by a preſſure thereof made on the Inſtrument of Senſe, ſo that the Motion is backward irom one Extream of the Organ to the other, where it terminates in the *Commune Senſorium*, commonly ſo called, and is therefore ſtiled *Perception*, *Paſſion*, or *Affection*.

The other is diſcharged by ſome manner of impulſe upon the Organ from within outwardly, with a tendency either to acquire ſome Good, or

or avoid ſome Evil; by which Impulſe, when carried on ſo far, either in a natural or moral ſence, as to terminate in, or to be executed upon its proper Object; the Object then may be ſaid to ſuffer as before in the other caſe it might be ſaid to act, and the perceptive Faculty now to act as before it might be ſaid to ſuffer, and this Action is commonly called *Local Motion*.

For whoſe ſake, ſeeing 'tis of different kinds, learned Men have thought fit to organize or divide the Brain into two diſtinct Provinces inveſted with ſeveral Rights and Juriſdictions abating the Power of the Senſitive Soul, which before was looked upon univerſal over the whole Brain, allowing it only a principal, but no abſolute Empire there: And this they have done upon no weak or unreaſonable grounds, ſeeing that *Local Motion* is not only in many reſpects performed without its aſſiſtance, but even againſt its power of reſiſtance; as in the Pulſation of the Heart, vermicular Motion of the Bowels, and in a great meaſure the Act of Reſpiration.

Now,

Now, that which hath been taken from the Brain hath been conferr'd on the *Cerebellum*, to which, though ſome Power in this Affair may juſtly be allowed, as was before obſerved, yet poſſibly not altogether ſo much as there hath been.

Dr. *Willis*, who is Chief in this Cauſe, having diſtinguiſh'd *Motion* into voluntary and involuntary only, hath made the *Cerebrum* accountable for the one, and the *Cerebellum* chiefly for the other; and to that end hath furniſh'd it with the like number of Nerves, as in his own words is expreſſed, *Ut diviſum cum ipſo* (i. e.) *Cerebro, imperium Cerebellum habeat*; nay, conſidering the Intercoſtal Pair, derived from the fifth and ſixth Pair, which belong to the *Cerebellum*, he hath made it exceed. Willis c. 11.

I am apt to think that Learned Perſon too ſoon fell in love with his firſt Thoughts, the ordinary reaſon of either ones ſeeing falſe, or not far enough.

No-

Nothing being more apparent, than that moſt of thoſe Actions of Animal Motions he calls *Involuntary*, and of which he gives ſo many Inſtances, are equally found in Brutes and rational Creatures too, whilſt in the ſtate of Infancy, as well as when grown up, with *this* only difference, that all of them in the laſt are under the controuling power of the Soul, and conſequently may be ſuſpended upon a reflex'd Act of the Underſtanding; whereas in Brutes and Infants they are neceſſary, and do as naturally enſue upon the impulſe of the Object, as Water, when unconfin'd, runs towards a Plain.

Now, if all theſe were ſuppoſed to be under the power of the *Cerebellum* only in Brutes and Infants, the Brain it ſelf muſt neceſſarily be thought altogether uſeleſs in them.

It will be neceſſary therefore to take notice, that there are two ſorts of Animal Motion in Brutes, as in Rational Creatures, the one purely natural, ſuch as is Pulſation of the Heart, and various contraction of the *Viſcera*, proceeding from a certain por-

tion of the Animal Fluid continually diſpenſed to the Nerves in an equal proportion, and ſo may be ſaid to have their cauſe originally co-exiſtent with the Creature, and always preſent: And this kind we find by a moſt convincing Experiment hereafter to be mentioned, to be from the *Cerebellum*, and abſolutely free from the dominion of the Brain, in its ordinary way of acting or influx.

The other is that of *Inſtinct*, relating to the Senſative Soul, or an aptitude of the Nervous Structure, to act according to the Impreſſions made upon the Nerves, either from within, or from without, and ſo may be ſaid to depend on the preſence of ſuch Cauſes as are ſupervenient and extraneous to Nature, ſuitable to the impreſſions whereof the *Animal* either purſues or avoids the Object, obeys, or reſiſts the Impulſe.

Now, I take it for granted, that no body will deny but that the Nerves (by vertue whereof theſe laſt actions of *Inſtinct* are performed) whether they ariſe from the *Cerebrum* or *Cerebellum*,

bellum, are equally under the command of the Soul; or elſe, as I ſaid before, the Brain in thoſe Creatures is to no purpoſe.

And of this ſort I reckon all thoſe actions in rational creatures of *Inſtinct* before they have attain'd to the uſe of their *Underſtanding*, from any ſort of Impreſſions, or inadvertent and inconſulted, when he hath the controuling power of Reaſon allow'd him and makes no uſe of it, ſuch as are called *Habitual*, which at firſt were produced by command of the Rational Part only, but through frequent repetitions at laſt, without any command from that, out of a blind obedience to a bare impulſe from the Object; or laſtly, ſuch as happen when he hath altogether loſt the uſe of it, as in Sleep or Diſtraction; in which laſt Caſes 'twill be very difficult to diſtinguiſh him from a meer Machine or *Automaton*.

Now, from what hath been ſaid, I cannot but think it plain, that many of the Actions before ſpoken of in Dr. *Willis*'s ſence, by him called *Involuntary*, as proceeding

from the dominion of the *Cerebellum* only, ſuch as he calls the various Configuration of the Face, from ſome Impulſe or Provocations in the *Viſcera* or elſewhere, erecting the Ears, turning the Neck and Eyes about, ſudden Shrieks and Outcries upon ſome extraordinary frightful Object ſurprizingly affecting one Senſe or another, furniſhed with either ſuch Nerves as he ſuppoſes to be altogether under the command of the *Cerebellum*, as the fifth and ſeventh, or elſe to have a very near correſpondence with that part by vertue of Vicinity, as the ninth, do more truly proceed from that perceptive faculty, or (to uſe his own words) that part of the Soul, he hath confin'd to that part of the Medullary Syſtem called the *Cerebrum*, inaſmuch as in reaſonable Creatures they may and commonly are ſuſpended, as well as the Nerves they flow from, ſometimes made uſe of as Inſtruments of Voluntary Motion by it alſo; and to think the contrary, is as much

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as to ſay, that when any body happens to expreſs any of the aforemention'd involuntary Acts, or but hit his Bedfellow a box of the Ear, whilſt aſleep, all theſe muſt be allow'd to proceed only from the Organ of Involuntary Motions called the *Cerebellum*.

And of this kind alſo in a great meaſure I reckon Reſpiration, concerning which I cannot eaſily be brought to think it ſatisfactorily explain'd by Dr. *Willis*, from the Energy of thoſe Animal Spirits which flow only from the *Cerebellum* in the *Par Vagum*, after the ſame manner they do to the Heart by the Intercoſtal and that Pair for its pulſation, and as only under the command of the Soul, to be ſtopt now and then, as it pleaſes, by vertue of ſome Nerves communicated to the Intercoſtal Muſcles and Diaphragm, the chief Inſtruments of breathing, from the *Spina Dorſi*.

I am therefore rather enclin'd to think this Motion is of the other different kind before ſpoken of, under the Title of *Inſtinct*, proceeding from an extraneous ſupervenient Cauſe, acting conformably to the courſe of Nature in o-other Caſes of the ſame kind, as in Hunger and Thirſt, and the like, where the obtaining the deſigned End or Effect renders the part from whence comes the Motion for ſome time inſenſible of the impreſſion, and where, after the ceaſing of the Effect or Motion, the ſenſe of the impreſſion revives again, whence there happens an equal reciprocation between the Senſe and Fruition, or Senſe and Motion.

To apply this account of the manner and reaſon of the Spirits acting upon the Stomach and Palate in relation to Hunger and Thirſt, to that of the *Syſtole* and *Diaſtole* of the Lungs or Reſpiration, 'twill be needful to take notice, that in an Infant unborn there is no Reſpiration, but yet there is a *Cerebellum*; and that if this ſort of Motion called

led *Inſtinct*, which I make to differ from purely *Natural Motions*, ſuch as are contemporary with even the firſt living Rudiments of the Individual, was altogether and ſolely owing to the *Cerebellum*, after the manner of that of the Heart; then of neceſſity the Child in the Womb ought to reſpire. But being ſatisfied of the contrary, it remains that we account for its reſpiration another way, which is as afore noted, through the preſence or abſence of the firſt moving Cauſe or Impulſe, which I make or ſuppoſe to be any thing impreſſing the Nerves, propagated through the Organs of Breathing, ſo as to tranſmit the impreſſion from within to the perceptive Faculty, preſiding both over the *Cerebrum* and *Cerebellum* too, to the end the Spirits may from thence forthwith be commanded into ſuch other Nerves as act thoſe Muſcles which ſerve for enlarging the whole Cavity of the *Thorax*, in order to let the Air into the Lungs more plentifully, which was the thing aimed at by Nature; and theſe

are the Intercoſtal Muſcles and Diaphragm.

Now 'tis eaſie to conceive, that whilſt the Child is encloſed in its Mothers Belly, there is not that occaſion for Reſpiration as when 'tis born, the main Stream of Blood all that while finding no paſſage thro' them, and that which does by the *Ruſſian Artery* made of Juices much more mild and cooler, the native heat being little, and the Aliment meer Chyle or Milk; from whence it falls out that the Pulmonick Nerves go altogether unprovoked, which after birth are continually otherwiſe impreſſed or provoked by the hot *Effluviums* of Blood, now bred of ſtronger Food, and by a ſtronger native heat, and wholly flowing through them; which heat continually, as the Child acquires a greater maturity, encreaſing, may, for ought I know, not a little contribute, by way of natural impulſe, to its excluſion.

The truth of this will the more clearly appear to any who will take the pains to conſider well of the ſtructure of Parts in Children un-

unborn, in whom the uſual circuit of Blood through the Lungs, which are deſigned for rarifying and perfecting the mixture of Blood and Chyle, is denyed; as alſo through the Liver, ſerving chiefly for ſeparating that groſs Excrement the Gall, not bred (at leaſt in any proportion) in an Infant unborn, and in lieu of theſe, other Paſſages, (which become altogether unneceſſary after birth) provided by Nature after a ſhorter and more compendious way, (*viz*) by the *Foramen Ovale* betwixt the *Vena Cava* and *Vena Pulmon.* and *Tubulus Arterioſus* between the *Art. Pulm.* and *Aorta* in the Lungs, and the *Tubulus Venoſus* between the *Sinus* of the *Porta* and the *Cava* in the Liver; as hath been moſt ſagaciouſly obſerv'd by the late Learned Dr. *Walter Needham.*

'Tis true, That in ſeveral Creatures there are ſome Nerves very much depending on the *Cerebellum*, as are they which miniſter (though in a different manner, as hath already been taken notice of, and will be hereafter further explained) to the Natural and Vital Functions, (*viz.*) the

the *Par Vagum* and Intercoſtal Pairs, and therefore the aforeſaid Author, who is in this as in many other of his Diſcoveries very fortunate, and highly commendable, made a very good gueſs when he brought theſe Faculties into ſubjection to that part, inaſmuch as by ſeveral others, as well as by my own Experience upon living Bodies, we find, that notwithſtanding moſt part of the Brain be pared off with a Razor, yea, even after the *Medulla Oblongata* be divided betwixt the *Cerebrum* and *Cerebellum*, and taken wholly out of the *Cranium*, the Heart will beat, whenat the ſame time if the *Cerebellum* it ſelf be but cut in pieces, though all the reſt of the Brain be kept entire, the Creature expires preſently.

Yea, I have ſeen Reſpiration (which only in part depends on the *Cerebellum*) totally to ceaſe upon only a ſudden violent compreſſion of that part by a blow, and, after its being wounded, the Heart to ceaſe beating immediately.

All

All which muſt of natural conſequence fall out upon the Hypotheſis, That thoſe Functions of Nature do depend on the *Cerebellum* for their ſource and influence, which is conſtant, uninterrupted, and out of the arbitrary juriſdiction of the Brain; yet with this difference, that in Motions purely natural, and either contemporary with the *Embrio*, as the firſt ſigns of its vitality, ſuch as is Pulſation of the Heart, during its encloſure within the Mother, or ſupervenient upon its further growth and more viſible organiſation of Parts, as the natural contraction of the other *Viſcera* ſubſervient to the offices of Protruſion of the Chyle, ſeparation of the Glandular Juices, and proſcription of the Excrements, the Animal Fluid or Spirits do altogether flow from the *Cerebellum*, the Nerves there both deſcending from the *Cerebellum*, and terminating in thoſe parts afore-mentioned; whereas in Reſpiration, which I call a Motion of Supervenient Inſtinct, (if I may be allowed to uſe the word

Inſtinct

Inſtinct in that ſence) the Nerves deſcending from the *Cerebellum*, and propagated through the Lungs from the *Par Vagum*, ſerve only to convey the firſt Impulſe or Impreſſion of the Object to thoſe parts which are by Nature framed and qualified to produce Reſpiratory Motion, and thoſe are the Nerves of the Spinal Marrow, receiving the impreſſion from the *Cerebellum*, ſeeing that by the aforeſaid Experiment it appears plain, that after the whole *Cerebrum* was divided from the *Cerebellum* and *Medulla Oblongata*, the act of Reſpiration continued for a conſiderable time entire, which Motion is dependent on the Senſative Faculty preſiding in the *Cerebellum*, tranſmitting the firſt Impulſe produced by the eighth Pair or *Par Vagum* (as before obſerv'd) and communicated thence to thoſe Spinal Nerves which act the Intercoſtal Muſcles and Diaphragm.

So that all the office of the *Par Vagum*, which is propagated thro' the Lungs, is to convey the Impreſſion from thence to the *Cerebellum*, which by vertue of its connexion

nexion with the *Caudex Medullaris* (from whence the Ancients rightly thought that part had its hindermoſt Roots from the *Cerebellum*, as before taken notice of) it is able to tranſmit it further, as the Senſative Faculty preſiding there ſhall direct, and that too by the common way, the *Medulla Oblongata* and *Spinal Nerves*.

And further; That this part is as capable thereof as the *Cerebrum*, and is not wholly and only deputed for the ſervice of ſuch Nerves or Organs as are employed by the involuntary part or portion of the Soul, (as Dr. *Willis* would have it) appears in that the third Pair of Nerves, by him allowed to be amongſt the number of the other kind of Nerves, (*viz.*) thoſe commanded by the Will, from hence (as hath been already ſhewn) hath its original. And here alſo furthermore give me leave to add, by way of conjecture, that the reaſon why the Soul hath not an equal command over thoſe afore-mention'd Nerves dedicated to the vital and natural Motions, is, the early date

or

or commencement of the office of those Nerves, by which means they contract an habitual irresistible Influx, much less so in those belonging to the Respiratory Functions, the exercise whereof is of a later date; and lastly, the Influx is not in the least so habitual in those other subservient to the Organical Functions of the Limbs, inasmuch as they are not capable of being exercised till a much longer time after, and then not so uninterruptedly as either the first or the second, but gradually, and with intermissions.

So that the only reason why upon cutting the *Cerebellum* Respiration ceases, is, that by that means its structure is discomposed, and render'd unfit either to receive or transmit the impression further to the aforesaid Nerves, which are subservient to the Instruments of Respiration.

'Tis true, there are reciprocal communications betwixt the Nerves of the *Intercostal Pair*, *Vertebræ*, and *Diaphragm*, yet seeing they terminate not immediately in the Parts of

of each others particular distinct jurisdictions, there is no interchangeable act or office from thence produced betwixt them.

For as, notwithstanding there are so many Branches of Nerves communicated from the Spinal Nerves subservient to voluntary motion, to the Intercostal Pair, on their descent to the *Viscera*, and yet by reason of their not terminating in those parts, they are not in the least able to bring these Nerves under the commands of the Rational Soul, by which provident Care of Nature it so falls out, that 'tis not in the power of any, by misguided Reason, to act injuriously to themselves: So by vertue of several Branches reciprocally communicated from the Intercostal Pair in its passage down to the *Viscera*, to the Spinal Nerves, there is no power given to them of moving the Muscles to which they are subservient uninterruptedly, after the meer manner of the *Viscera*.

But

But now, to return to where we left off, in ſome Creatures it's very plain, that Nature hath extended this imperial reſidence of the Soul beyond the *Cerebellum*, even as far as the *Spinalis Medulla*, having not only put this laſt motion, but that of Pulſation too, under the juriſdiction of that elongation of the Brain; as appears in the famous Experiment of the Induſtrious *Caldeſi* upon the Tortoiſe, which after the Head was cut off lived, and carried its Shell about, the ſpace of ſix Months.

Beſides which, 'tis remarkable, (by way of digreſſion) according to another Experiment by the aforeſaid Author made upon that Creature, that after even the Heart and all the *Viſcera* beſides, were taken out, except the Lungs, that Creature (to uſe his own Expreſſion) was found ſo to reſiſt Death, as to turn it ſelf from the inverted or ſupine poſition it had been placed in, in order to make the Experiment, to its prone or natural one, and to live and move ſix hours after. From whence

whence it appears, that *Muſcular Motion* is capable of being performed by the Animal Fluid alone, without the concurrence of the Blood, by moſt Authors conſtantly hitherto made to go a ſhare therewith in the performance of that action. *Caldeſ.* p. 75, 76.

So that we find Nature hath not ſtinted it ſelf to one place for the Seat of the Senſative Soul, or Reſervatories of the Animal Spirits ſo called, in order to the diſcharge of the afore-mention'd Functions, no more than it is at a loſs about the maintaining them in their Integrity by other ways, when it hath ſo fallen out that the natural ſtructure of the Organs, deſtin'd by Nature to that end, have utterly been deſtroy'd, of which we have many Inſtances in the *Anatomical Hiſtory*, thoſe Functions in ſeveral Creatures remaining perfect, where after death there have been found neither any *Cerebrum* or *Cerebellum* at all, or at leaſt ſuch as by their conſtitution was utterly render'd uſeleſs to any ſuch end.

Of the firſt is an Inſtance of the Learned *Wepfer*, in a Child living ſixteen hours after it was born, and diſcharging all the Duties of Nature that one of its age was capable of, and by the by (which all the patrons of a nutritious Juice by the Nerves may do well to take notice of) of a very ſtrong and good habit of Body, whoſe Brain, after death, was found to be only an heap of Watery Bladders or *Hydatides*, except a ſmall part at the bottom of the Skull, lying in a *Sinus* made in the Wedglike Bone, where the Pituitary Gland is commonly found conſiſting only of three Medullary Bodies, two of which being each of the bigneſs of a Kidney Bean, and the third behind them of a Pea only, from which indeed there did proceed ſome, but very inconſiderable Nerves, or Nervous Fibrils, but ſuch as none can judge of a due proportion requiſite to ſatisfie the Exigencies of the common natural, and vital Functions. *Miſc. Curioſ. An.* 3 p. 120

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The truth of which is ſtill more plain, and without exception, in another Inſtance in the *Miſcell. Med. Phyſic. Gallic.* of a Child living five days after it was born, whoſe Head had nothing but Water contained within the incloſures of the *Dura* and *Pia Mater*, without the leaſt footſteps of any medullary part at all. *Miſc. Med. Phyſ. Gall.* An. 3. p. 54.

Parallel to which two laſt Inſtances, I had one communicated to me by that curious Anatomiſt and learned Perſon Dr. *Tyſon*, in a Child born alive, with no more Brain in the Skull than what might lye in a Filbird-ſhell, the *Medulla Spinalis* being much larger than ordinary, as though part of the abſent Brain had been ſqueez'd down thither.

Of the laſt (*viz.* where the natural conformation hath been depraved) there is extant an Inſtance in two ſeveral places of the *Miſcell. Curioſ.* in a fat Ox, in which while living there were obſerv'd but very little ſigns of any ſuch thing, whoſe Brain was nevertheleſs after death found wholly petrified. *Miſc. Cur.* Obſ. 26. & 130. An. 1.

From all theſe 'tis manifeſt the Senſative Faculty is able to anſwer its internal or external Impreſſions, by one part as well as another, and that the Medullary Syſtem of the *Spinalis Medulla* may become as adequate a Senſory, in relation to the aforeſaid Functions ſometimes, as either *Cerebrum* or *Cerebellum*.

And as to the power or influence the Soul in general exerciſes over the Nerves, howſoever different in their original, ſeeing we have already obſerved what a provident care Nature hath taken for the preſerving Creatures from their own violence, in that it hath not only conſtituted the chief Fountain from whence the great current of Spirits is derived, for the ſervice of the vital and natural parts, by the Eighth and Intercoſtal Nerves, which is the *Cerebellum*, ſo as to be free from the commands of the Rational Will in its ordinary way of acting, but hath alſo taken care that not any of thoſe Branches which have their originals from Trunks, which are under the power of voluntary dictates of the Soul, ſhould

ſhould terminate in ſuch Organs by which thoſe Functions are diſcharg'd, (a bare communication between Nerves of different Provinces not being ſufficient to ſuch ends or offices, as hath been obſerved in thoſe afore-mention'd additional ſubſidiary ſmaller Streams of Spirits flowing to the parts conſecrate to the natural and vital Functions by Branches propagated from the Spinal Marrow, to the Intercoſtal Nerve, all the way of its deſcent to the lower *Venter.*)

So we may further alſo remark, that as there are ſome manner of Impreſſions made upon the perceptive Faculty, after ſuch ſort of a manner as that it even loſes its power over its own Subjects, (*viz.*) the Nerves, which are ſubſervient to its voluntary commands, as in *Laughing*, *Sneezing*, and *libidinous Erections*, the Organs by which theſe Actions are produc'd, being altogether under the power of thoſe Nerves ſubſervient to the voluntary dictates of the Soul, and acted after the very ſame manner as thoſe of Reſpiration, as often as proportionable objects preſent, and (notwithſtanding the aſſertion of Dr. *Willis*

lis to the contrary, who makes Laughing proper to Man only, and, by the authority of *Ariſtotle*, Sneezing an Affection proper but to few, if any other Creature, beſides Man) might alſo produce the ſame effects in Brutes, provided their ſtupid Souls were capable of being equally impreſſed by ſuch Objects as are proper for exciting a rational Laughter, as we ſee they are by thoſe producing the aforemention'd *venereous actions*, ſeeing the want of the *Plexus Cervicalis*, of the Intercoſtal Nerves, and two or three ſmall Branches propagated from thence to the Nerve of the Diaphragm (which he calls a Diſpoſition peculiar to Man, and conſequently in his opinion the cauſe of that Affection in him) might be in a great meaſure ſuplied not only by that nervous Branch we find propagated from the inferiour *Plexus* of the *Par Vagum* (which Nerve is equally dependent on the *Cerebellum*, as the Intercoſtal) to the third Brachial Nerve, from which the Nerve of the Diaphragm hath one of its originals, but alſo by that other propagated from the *Thoracick Plexus* of the Intercoſtal *Will* p 106

coſtal Nerve it ſelf, to the ſame aforeſaid Brachial Nerve, into which the Nerve of the Diaphragm is inſerted.

So, on the contrary, there are ſome Impreſſions made upon the Soul ſometimes, through which it acquires a power over thoſe Nerves at other times in no wiſe ſubject to it, and thoſe are the impreſſions either of great Joy or great Grief, ſuitable to which the Vital and Natural Faculties are made either much more or elſe ſo much leſs vigorous than ordinary, as even quite to languiſh.

How this comes to paſs, according to Dr. *Willis* in favour of his own Hypotheſis, and particularly in relation to the firſt, (which allows of no Involuntary Motions, but what come from the Province of the *Cerebellum*) is explained by ſuppoſing an undulating or rowling motion of the firſt impreſſion upon the Brain out of it again, through the Natiform Proceſſes into the *Cerebellum*, and from thence by the Annular Proceſs into the Intercoſtal Pair of Nerves, and ſo to the Nerve of the Diaphragm, (and he ſhould, to make this way of explication

entire, have taken in alſo all thoſe Vertebral Branches inſerted into the Intercoſtal Nerve, in order to the moving of the Intercoſtal Muſcles, without which that action cannot be performed) by a correſpondence between which Nerves and thoſe of the Face, being all of one family, the aforeſaid Geſture of Laughing is performed.

Now, beſides the needleſneſs of bringing the Conceptions or Impreſſions of the Brain under a neceſſity of being executed by the inferiour Province of the *Cerebellum*, till ſuch time as 'tis proved, that ſuch motions of the Spirits, upon extraordinary occaſions, may rationally be granted, without ſuppoſing a regular motion of the ſame through ſuch ſuppoſed Paſſages leading from one Part to the other at all other times, (the allowing whereof does neceſſarily imply a capacity of the Soul to alter the courſe of the Spirits influencing the vital and natural Organs, at leaſt in ſome meaſure, at its pleaſure, which is plainly contrary to Experience;) I ſhall hardly look upon that Hypotheſis

pothesis to be any more than meerly precarious.

And further, to shew, that such Effects or Alterations of the Vital Organs happening upon violent Passions of the Mind, are no way owing to such a transmission of the Animal Fluid from the *Cerebrum* to the *Cerebellum*, as the aforesaid Author supposeth, I ask, how it should come to pass that in the contrary Passion of Grief, especially when occasion'd by surprizing frightful Accidents, the Heart should so languish, as sometimes wholly to cease beating, seeing in the aforesaid Experiment we find that Motion self-sufficient, by vertue of a constant irradiation or influence of the *Cerebellum* only, and consequently could not be thought so to languish upon such occasions for want of those Spirits it never stood in need of.

Without therefore being forc'd to have recourse to that other Hypothesis clogg'd with so many difficulties, I think the aforesaid case may admit of another manner of explication, consistent with what I have all-along advanc'd upon this Subject rela-

relating to the true ſource of voluntary and involuntary Actions: if we ſuppoſe, that from ſuch Impreſſions upon the Soul as are either extreamly more or leſs welcome to it, (in which caſe the Object is ſaid to act unproportionably upon the Subject) it may not only act accordingly, above its uſual irradiation and force over the *Cerebellum*, and by that means, as ſending the Spirits either more or leſs copiouſly to the Vital Organs, particularly the Heart, the neareſt way, (*viz.*) by the *Par Vagum* and Intercoſtal Pair, for that time render them more vigorous, or more languid in their operations, in proportion to the difference of the Paſſions, juſt after the manner it happens in caſes of Alienation of Mind or Diſtraction, where by the Strength of the Impreſſion, or *Idea* upon the Mind, it drives the Spirits with ſuch an *impetus* into the Limbs, as makes them act with a vaſt greater force than what they were wont to do, even above the reſiſtance of Chains or Bars of Iron; but alſo it may tranſmit the Spirits more or leſs copiouſly

piouſly, to the Vital and Natural Faculties, the other way freed from the ſubſidiary Nerves of the *Spina* aforementioned, to the Intercoſtal Pair, which ſends forth ramifications to the Heart (in Men eſpecially) equally with, if not more plentifully than the *Par Vagum*, and from the Vertebral and Brachial to the Nerve of the Diaphragm and Intercoſtal Muſcles, by which means it ſo falls out, upon ſuch impreſſions, that the Organs of Reſpiration to the *ſight*, and that of Pulſation to the *touch*, are very remarkably affected.

By this means I have endeavour'd to reſtore the Brain to a capacity of putting its own Conceptions or Impreſſions made upon it into execution, without being beholden to its neighbour the *Cerebellum*, and that either in relation to its voluntary, inadvertent, or involuntary Acts; where, note, I make a diſtinction between Acts involuntary and thoſe of inadvertency, inaſmuch as theſe laſt, though they are not with, yet they are not contrary to the actual conſent of the Will, after the manner of the natural actions of the *Viſcera*, ſuch

ſuch as are out of the power of the Will to hinder; beſides which, I look upon no other in Rational Creatures (in a ſtrict ſence conſider'd) to be involuntary, foraſmuch as 'tis a contradiction to ſay a Voluntary Agent does any thing againſt his Rational Will (though it may be againſt his Approbation) by which he is only diſtinguiſh'd from a Brute: Though Dr. *Willis* hath all-along uſed the word *involuntario* in another ſence, confounding it with acts of meer Ignorance under the term of *Inſcie*, and thoſe alſo done only inadvertently, or without conſideration, under the term of *Inconſulto*; and doubtleſs upon this notion of Involuntary Motions built his Hypotheſis, which makes all thoſe Actions which are perform'd at any time without the notice of the Intellectual Faculty, notwithſtanding at other times they are altogether under its command, equally depending on the *Cerebellum* as thoſe purely natural, which are always free from the power of the firſt, and alſo abſolutely ſubject to the laſt.

Theſe

Theſe Actions I have therefore called by the term of *Supervenient Inſtinct*, and being the meer Effect of external or internal Impreſſions upon Senſative Bodies, as Ecchoes are to thoſe upon ſuch as are only natural, are equally competent to Rational and Irrational Creatures, and capable of being exerted by the influence of the very ſame Nerves which miniſter to the Senſative Faculty, whether it act advertently or inadvertently in the one, or *ſpontaneouſly* in the other, (where, by the way, it may not be altogether unworthy of our taking notice, the genuine ſence of that word in Actions performed by thoſe Creatures, is much nearer a-kin to the term *Inconſulto* than *Involuntario* in Men) without the ſuppoſed rambling Motions of Impreſſions made upon it, (through Paſſages only at ſome times or upon extraordinary occaſions made uſe of) out of the *Cerebrum* into the *Cerebellum*.

Now, as to the organiſation of this Part, made to conſiſt of various Medullary Prominencies, Appendixes, and Tracts, by Nature contrived for and adjuſted to the various functions

of

of the Soul, and diſpenſation of the Animal Spirits thro' the whole Syſtem of the Nerves, which firſt are confin'd to, or made to reſide in ſuch and ſuch places as ſo many diſtinct apartments, *viz.* the *Commune Senſorium* in one place, the Imagination and Judgment in another, and the Memory in a third; of which there is ſuch a large and formal *apparatus* and deſcription (tho' with great diſcrepancy of opinion) in *Willis* and *Vieuſſenius*, the one placing the *Commune Senſorium* in his *Corpora Striata* only, the other in the *ſuperiour* and *middle Corpora Striata*, jointly with the *Centrum Ovale*; from both whom *Des Cartes* and ſeveral others, and with much more ſhew of Reaſon, particularly *Malpighius*, differ, placing it in the extream limits of the medullary part of the Brain, where 'tis continuous with the cineritious circumaffuſed Part; I muſt confeſs, that as I have not been able, by the beſt enquiry I could make either into Brains diſſected whilſt freſh, or when boiled in Oyl, to diſcover any ſuch actual configuration or diſpoſition of Parts, as we find ſo formally delineated by either

Malpig. de Cerebr. p. 111 par. 2.

ther of them, but eſpecially the laſt.

So neither do I ſee any neceſſity thereof, ſeeing we may much more eaſily, and to the ſelf-ſame ends and advantages, look upon the Soul as one internal principal Senſative Faculty. and the whole medullary part of the Brain, as conſiſting of ſuch Fibrils or *Vaſcula's* as in ſome places more nearly in others more remotely communicate with the Nerves propagated thence to all the external Senſories, one adequate *Commou Senſory*, by which that principal Faculty both receives all its impreſſions, and accordingly, as by ſo many gradations of one and the ſame power, executes or performs thoſe different Functions commonly going under the aforeſaid Names of *The Common Senſe*, or *Simple Apprehenſion*, *Imagination*, *Judgment*, and *Memory*.

And as to the ſecond, (*viz.*) the Medullary Tracts, by which the Animal Fluid, as by ſo many Rivulets, is derived from the great Pond or Magazine into many Rivers, furniſhing the whole Body therewith, all I could find by the moſt diligent ſearch,

ſearch, were only thoſe which have already in the preceding Sheets been remark'd, of which, in the firſt place, are thoſe in the *Corpora Striata*, very large and diſcernable.

Thoſe in the inward or concave Superficies of the *Corpus Calloſum* running tranſverſely by the *Septum Lucidum* into the *Fornix*, and from that longitudinally into its hinder Thighs or Pillars formerly called *Bombyces*, over which they run in a wreathed manner, as was before obſerved, terminating in the back part of the Lateral Ventricles, encloſed in the hinder Limbs of the Brain, which Ventricles at length terminate in, and are continuous to the ſubjacent fore-part of the *Crura Medulla Oblongata*.

Thoſe in the *Thalami Nervorum Opticorum* running obliquely down to part of the ſubjacent *Crura* and *Caudex Medullaris*.

Thoſe of the *Nates* and *Teſtes* running after the ſame manner, and terminating ſo too, only ſomething lower.

Thoſe

Thoſe in the Annulary Proceſs, which foraſmuch as they have never before been taken notice of, I have cauſed to be engraved in a Figure by themſelves, whoſe Medullary Tracts or *Striæ*, furniſhed with Spirits both from the continuous medullary *Caudex*, and Productions of the *Cerebellum* too, of which the Annular Proceſs is made, (by means whereof the Nerves appertaining thereto may be rationally ſuppoſed to be under the influence of both thoſe Parts, conformable to what hath all along been aſſerted;) are as viſible, being more thick, and of a far harder conſiſtence, than that of the *Corpora Striata* themſelves, (tho' upon every attempt of cutting that Proceſs, they may not appear ſo) and moſt of them terminating in a middle Medullary Tract, by means whereof there is the ſame inconveniency prevented, at leaſt in ſome meaſure, as there is by that *ſepimentum* of the *Pia Mater*, continued from the joyning together of the *Crura Medulla Oblongata*, down quite thro' the *Medulla Spinalis*, (*viz.*) that at the ſame time the Nerves on one ſide

may, (as *Molinetti*, tho' in another place of the Brain, hath truly obſerved) by any morbid cauſe, be injured, thoſe on the other may eſcape. *Mol.* p. 104

Concerning theſe, ſeeing they ſeem to have a particular aſpect or relation to thoſe Nerves, whoſe originals we find neareſt them, it may not be unreaſonable to think they are particular Conduits, from whence the ſaid Nerves are furniſhed with Animal Fluid, though at the ſame time we muſt allow a very free communication betwixt them all.

And conſequently, we may ſuppoſe the firſt of thoſe to convey Spirits from the globous medullary part of the Brain next to it, by *Vieuſſenius* called the Superiour Part of the *Centrum Ovale*, down to the ſubjacent medullary part of the Brain, to augment thoſe which are produced lower, and particularly for the ſervice of the *Olfactory* and *Viſory Nerves*, which laſt hath more eminently its Supply from the *Thalami Nervorum Opticorum*.

The

The ſecond ſort, or the tranſverſe *Striæ's* of the *Corpus Calloſum*, to convey an additional Supplement by way of the wreathed Tracts in the hinder Columns of the *Fornix*, to the *Crura Medulla Oblongata*, where they become continuous to the reflex'd part of the Lateral Ventricles backwardly, for the ſervice alſo of the aforeſaid two Pair of Nerves, but more particularly to thoſe ariſing lower either on the Annular Proceſs or *Caudex Medullaris*.

Thoſe of the *Thalami Nervorum Opticorum* and Natiform Proceſſes, the firſt of which lies upon, and is continuous to the ſubjacent medullary part of the *Crura Medulla Oblongata*, the other to the *Caudex Medullaris*, may be ſuppoſed to derive Spirits on the behalf of thoſe Nerves which ſpring from any adjacent parts, whether on this or the other ſide of the Annular Proceſs or *Caudex Medullaris*.

And of this ſort are the *Optick Nerves*, which are ſupplied *immediately* from the firſt of thoſe Medullary Prominencies, and not unlikely from thoſe fair Medullary Tracts afore-mentioned, running from the Root of the *Fornix*, extending themſelves all the way between the *Corpora Striata* and *Thalami Nervorum Opticorum*, in which laſt at length they are obliterate. The Third, Fifth, Sixth, and Firſt or hard Branch of the Auditory Nerves, *mediately* by continuity of them with the Annular Protuberance, to all which the other or leſſer Medullary Prominencies called *Nates*, by vertue of their continuity with the ſubjacent parts, may be ſuppoſed to contribute ſomething alſo: and theſe ſeems to be better provided for than the reſt of the Nerves, inaſmuch as beſides this way of being ſupplied from the *Cerebrum*, they have alſo another very viſible, and much larger, from the Second Proceſs of the *Cerebellum*, of which the Annular Protuberance

tuberance is made, and this ſeemingly not without a provident Deſign of Nature, ſeeing the Nerves which are derived thence are much larger, and have a greater Task of ſervice layed upon them than any others of the whole Brain, as hath alſo the *Par Vagum*, or eighth Pair, which therefore, by vertue of its inſertion between the Chordal or third Proceſs of the *Cerebellum* and *Corpus Olivare* (and not according to Dr. *Willis*, from the points or extremities of the *Corpora Pyramidalia*) hath a double tribute of Spirits, one from the *Caudex Medullaris* or *Cerebrum*, the other from the *Cerebellum*.

And to this End or great Service it looks as though this Proceſs was furniſhed with ſuch a Texture as it appears to have, of ſtrong, large, medullary *Striæ's*, capable of receiving and containing a Supply from both Fountains.

Whence

Whence it may not be unſeaſonable to remark, That not without ſhew of good Reaſon I have all-along aſſerted the Propriety of the Brain to thoſe Nerves in part, allowed by Dr. *Willis* to be no further affected by any Impreſſions of the Brain, than as firſt conveyed from it into the Province of the *Cerebellum*, and conſequently to depend immediately on this laſt for influence entirely in order to convey Animal Spirits to thoſe parts wherein they are inſerted.

Upon the *Caudex Medullaris*, on its under ſide contiguous to the hinder Extremities of the Annular Proceſs, are ſituate the *Corpora Pyramidalia* and *Olivaria*, over-againſt which are the two long Medullary Tracts lately taken notice of, ſeeming to come from the tranſverſe Medullary Proceſs behind the *Teſtes*, and terminating in thoſe other tranſverſe Medullary Proceſſes before the entrance into the Fourth Ventricle on the other ſide,

ſide, by which there may be conveyed a conſiderable Portion of the Animal Fluid to the Pathetick Nerve, which hath its riſe from the firſt tranſverſe Proceſs, and to the ſoft or ſecond Branch of the Auditory Nerve, which hath its riſe from the ſecond on that ſide, and alſo to the Ninth and Tenth Pair on the other ſide.

And to conclude, From all theſe taken together, with the reſt of the whole medullary part of the Brain, the *Overplus* of what is not ſpent upon the inmate Nerves of the Brain may truly be ſuppoſed to be promiſcuouſly diſpenſed to all thoſe other extraneous ones produced from the elongation of the Brain, call'd the *Spinal Marrow*. In which laſt there is this conformation or diſpoſition of Parts differing from that of the Brain, that whereas in that the cineritious part is external, 'tis here internal; and this for very good reaſon, and by a provident contrivance of Nature, ſeeing that not only the cineritious part of the Brain ſerves for ſup-

ſupplying thoſe Nerves which have their original thence, as well as all the reſt of the *Spinal Marrow*, and conſequently ought to have the largeſt ſpace and dimenſions poſſible, which without this ſituation could not have been; but alſo without this contrivance the Nerves of this part muſt of neceſſity have had their originals from the cineritious part of the aforeſaid Marrow, contrary to both the cuſtom and convenience of Nature too.

THE

FIG. I.

Exhibits the Basis of the Brain, with part of the Medulla Oblongata, *the Blood-vessels being injected with Wax.*

A A The fore Lobes of the Brain.
B B The hinder Lobes.
C C The *Cerebellum.*
D D The lateral *Sinus's.*
E E The Vertebral Arteries as they pass between the first *Vertebra* and the Bone of the *Occiput.*
F The Vertebral *Sinus.*
G, &c The *Dura Mater* on the right side taken off from the Spinal Marrow, and remaining on the left.
1, 2, 3, 4, &c. The ten pair of Nerves belonging to the Brain, with seven of the Spinal Marrow.
a The *Foramen* that opens into the Pituitary Gland from the *Infundibulum.*
b b The two white Protuberances behind the *Infundibulum.*
c c The two Trunks of the Carotid Artery cut off where they begin to run betwixt the fore and hinder Lobes of the Brain.
d d The two Arteries joyning the Carotids with the Cervical Artery, called the Communicant Branches.
e e Two large Branches of the Cervical Artery, sometimes seeming as tho' they came from the Communicant Branch on each side, from the first of which the *Plexus Choroeides* hath its original in chief, and from the last the *Plexus Choroeides* of the 4*th* Ventricle.
f Several little Branches arising from the Carotid Artery.
g The Cervical Artery composed of the two Trunks of the Vertebral Artery within the Cranium.

The Explanation of the Figure.

h h The two Trunks of the Vertebral Artery.
i i i The Spinal Artery.
k A ſmall Branch of an Artery running through the 9*th* pair, broken off from its other part thro' inadvertency of the Graver.
l l The *Crura* of the *Medulla Oblongata.*
m m The Annular Protuberance, or *Pons Varolii.*
n That part of the *Caudex Medullaris* on the right ſide called by *Willis* and *Vieuſſenius* Corpora Pyramidalia.
o That part on the ſame ſide called *Corpus Olivare.*
p The foremoſt Branch of the Carotid Artery, dividing the fore Lobes of the Brain, conſiſting of two Branches, one of them only appearing here.
q q Little Branches of Arteries helping to make the *Plexus choroeides* in the 4*th Ventricle.*
r r r Branches of Arteries diſperſed from the Cervical Artery upon and thro' the Annular Protuberance.
s s Part of the 2d Proceſs, or *Podunculi*, of the *Cerebellum.*
* * The Spinal Acceſſory Nerve.

FIG. II.

Shewing the internal Baſis of the Cranium, *the* Sinus's *being injected with Wax.*

AA The Edges of the Skull.
BB The *Dura Mater* upon the bottom of the Skull.
CC The lateral *Sinus*'s
d d The ſuperiour, longer and narrower *Sinus's.*
e e The inferiour, ſhorter and wider *Sinus's.*
f The Proceſs of the Bone *Cribriforme*, called *Criſta Galli.*
g g Some ſmall deſcending Branches of Veins upon the bottom of the *Dura Mater.*
h h The firſt Branch of Arteries proper to the *D. Mater.*
i i The ſecond Branch of Arteries belonging to the *Dura Mater.*
k The third Branch belonging to the *Dura Mater.*
L The laſt hole of the Skull.
m m Several Veins communicating with the inferiour ſhort *Sinus's.*
n Part of the *Os Jugale.*
o o The *Os Ethmoeid*, where the firſt pair of Nerves or mammillary Proceſſes go forth.
p p The Optick Nerves cut off.
q q The Carotid Arteries cut off.
r The third pair of Nerves viſible only on one ſide.
S S The fourth pair of Nerves turned up.
t t The fifth pair of Nerves on one ſide expanded before it is divided into its three Branches, on the other ſide whole; which Nerves, with its three Branches, are expreſſed in the third Figure.
V Its foremoſt ſuperiour Branch on the left ſide, going out at the ſecond hole of the Skull.
w The ſixth pair of Nerves.

The Explanation of the Figure.

X The Intercoſtal Nerve, in this ſubject proceeding from two Branches of the fifth Nerve, joyning with the body of the ſixth Nerve.

y Two Branches of the fifth pair of Nerves, in this ſubject running almoſt cloſe to the 6th pair, being partly the Roots of the Intercoſtal Nerve, which creeps out of the Skull under and between the Coats of the Carotid Artery.

z z The Body of the Carotid Artery, after it has entred the Cranium.

1 1 The *Glandula Pituitaria.*

2 2 The Circular Sinus.

3 The *Infundibulum.*

4 4 The Frontal Arteries.

5 The place where the Lateral Sinus's begin to be declive and tortuous.

6 The *Dura Mater* raiſed and reclined to ſhew the ſubjacent Nerves.

7 7 The ſeventh or Auditory Nerves.

8 8 The eighth pair, or *Par Vagum.*

9 9 The ninth pair.

FIG. III.

Being the Fifth Nerve, with its Branches, whilſt within the Cranium.

A Its Trunk.

B Its Ganglion.

C Its firſt or ſuperiour Branch, going out at the ſecond hole of the Cranium.

D Its ſecond or midle Branch, going out at the ſecond hole.

E Its third or hindermoſt Branch, going out at the fifth hole.

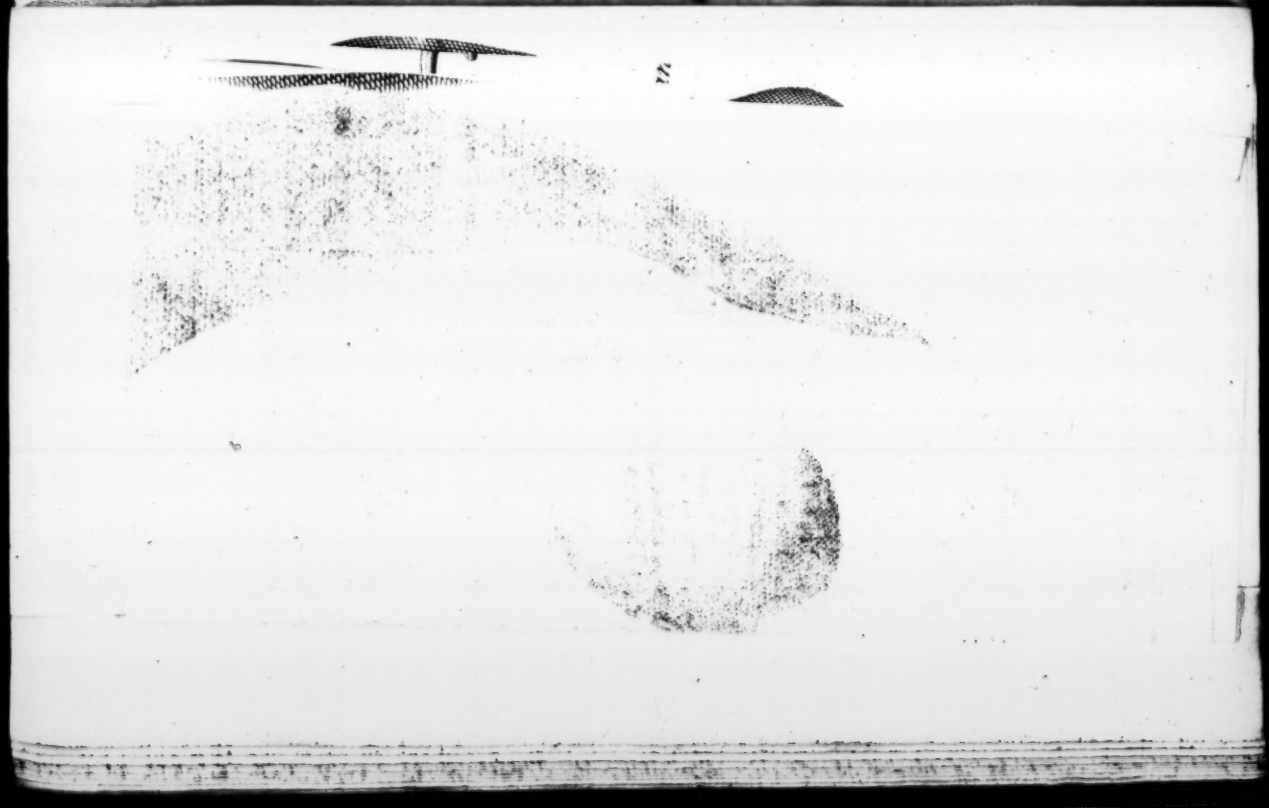

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FIG. IV.

Shews the ſuperiour and lateral Sinus's *of the* Dura Mater, *opened after they had been injected with Wax.*

A A The third or longitudinal *Sinus.*

B B The firſt and ſecond, or lateral *Sinus's.*

C The fourth *Sinus.*

d d d A Vein running on each ſide of the third *Sinus.*

e e e e Mouths of Veins opening into the longitudinal *Sinus* of the *Dura Mater*, after a contrary manner one to the other.

f f The fifth *Sinus* at the bottom of the *Falx.*

g The *Torcular*, where all the ſuperiour and lateral *Sinus's* meet.

h h The tortuous part of the lateral *Sinus* running under the *Cerebellum.*

i i The Veins entering the fourth *Sinus* from the *Plexus Choroeides.*

k The place where the fourth *Sinus* ariſes.

* * The *Specus* or round hole at which the lateral *Sinus's* on each ſide go out into the internal Jugular Vein.

l l Two large Veins, whereof one enters the fourth *Sinus* upon the ſecond Proceſs of the *Dura Mater*, ſo as to reſiſt the courſe of the Blood in that *Sinus*, in its aſcent to the Torcular; the other upon the ſame Proceſs, ſo as to hinder its deſcent to the *Internal Jugular*, contrary to a conformation of Veſſels which *Vieuſſenius* mentions in his third Table, H H.

n m m m Tranſverſe Chordal Ligaments in the longitudinal and lateral *Sinus's.*

n n Part of the *Dura Mater* on each ſide of the longitudinal *Sinus.*

o o Portions of the *Pia Mater.*

p p &c. Divers ſmall Veins on the *Dura Mater*, which enter thoſe that run on the ſides of the longitudinal *Sinus*, according to its length.

q q, &c.

qq&c The Veins of the *Cerebrum* as they appear under the *Pia Mater*, before they enter the longitudinal *Sinus*.

R R The falcated Proceſs, with its Veins which enter the fifth *Sinus*.

S S The ſecond Proceſs of the *Dura Mater*.

† † The beginnings of the Jugular Veins.

FIG. V.

Repreſenting the Brain in a middle ſection, the Blood-veſſels being firſt injected with Wax.

A A The *Fornix* cut off at its Roots and turned back.

b b Its Roots at the beginning of the *Thalami Nervorum Opticorum*.

cc,&c. The *Thalami Nervorum Opticorum*.

d d That part of the *Crura Fornicis* which growing ſomewhat thicker as it turns off towards the Lateral Ventricles, runs over the *Crura Medulla Oblongata*, which being very prominent in Sheep, and Calves, helps to thruſt it up into ſuch a Protuberance as the Ancients called *Bombyces* or *Hyppocampi*.

e e That part of the *Plexus Choroeides* which is made of the firſt Branch of the Cervical Artery, ſometimes ſeeming as thô it came from the Communicant Branch, in the Lateral Ventricles.

f The place where thoſe two *Plexus's* on each ſide meet under the *Fornix*.

g g That other part of the *Plexus* which is made of the ſecond Branch of the Cervical Artery joyned with the firſt by a Communicant Branch not to be ſeen here, lying under the *Crura Fornicis*, which is expanded all over the *Iſthmus*, becoming glandulous near to, and eſpecially under the *Glandula Pinealis* covered here with the *Fornix*.

The Explanation of the Figure.

h h Two large Veins coming from the top of the upper part of the *Plexus* down to the other Branch of the *Plexus*, all the length of the third Ventricle, and then terminates in the fourth Sinus.

i i The Trunks of several Arteries, appearing as they were cut off in dividing the Medullary † and Cineritious * part of the Brain.

k k A Venous Branch on each side entring the *Plexus Choroeides*, from whence there are many slips branched upon the *Corpora Striata*.

Δ Δ The *Corpora Striata* whole.

l The *Rima* of the third Ventricle.

m m A long Medullary Tract between the *Thalami Nervorum Opticorum* and *Corpora Striata*.

nn, &c. The *Centrum Ovale* of *Vieussenius*.

O The fourth Sinus of the *Dur. Mater*.

P The *Torcular*, where the four, and sometimes five, Sinus's meet.

Q Q The Lateral Sinus's.

R A large Vein entering the Lat. Sinus's on one side.

SS, &c. The *Cerebellum* covered with the second Process of the *Dura Mater* on its uppermost part,

T T The Vertebral Arteries.

V V The Vertebral Sinus's.

W The *Medulla Spinalis*, with its integuments.

x x The Style supporting the large Veins of the *Plexus Choroeides* in the third Ventricle.

q q The *Lymphæducts* of the *Plexus Choroeides*.

Y Y Two of the Cervical Nerves springing from the *Medulla Oblongata*.

††, &c. The Medullary part of the Brain.

**, &c. The Cineritious part.

FIG.

FIG. VI.

Being a draught of the Annular Protuberance, Med. Spinalis, &c. *cut through the middle lengthway.*

A A The *Crura Medulla Oblongata.*
B B The Annular Proceſs, or *Pons Varolii* divided.
c c The Tranſverſe *Striæ.*
e e The intervening Medullary Tract in which the *Striæ* terminates on each ſide.
f f The third or chordal Proceſs of Dr. *Willis.*
h The Spinal Marrow.
i i Some part of the *Cerebellum.*
k k The ſecond Proceſſes of the *Cerebellum,* which compoſe the Annular Protuberance.
l l The cineritious part of the *Medulla Oblongata.*

FIG. VII.

Being the Cerebellum *cut through on its hinder part, and reclined laterally.*

A A The *Cerebellum.*
B B The arboreous ramification of the *Meditallium* of the *Cerebellum* appearing, being cut right downwards.
C C The Pathetick Nerves.
c c The *Nates.*
d d The *Teſtes.*
e The tranſverſe Proceſs whence the Pathetick Pair have their original.
f The *Glandula Pinealis.*
g g The firſt Proceſs of the *Cerebellum* running from it to the *Nates* here extended laterally.
h h The third or Chordal Proceſſes.
i i The tranſverſe medullary Proceſs in the 4 Vent. from whence the ſoft Branch of the 7 N. has it original.
k k The Medullary Proceſs deſcending from the Tranſverſe Proceſs behind the *Teſtes,* down to the aforemention'd other Medullary Tranſverſe Proceſs.
l l The Originals of that Proceſs a little too low.
m m The eighth pair of Nerves.
n The *Calamus Script.* or Extremity of the 4th Ventricle
o The Spinal Marrow.
P P The Acceſſory Nerves.
q q The tenth pair of Nerves.

arter..., why their Ramifications are over-proportionable to the Trunks in the Brain, p. 55

n The [illegible] entricle
o The Spinal Marrow.
P P The Acceſſory Nerves.
q q The tenth pair of Nerves.

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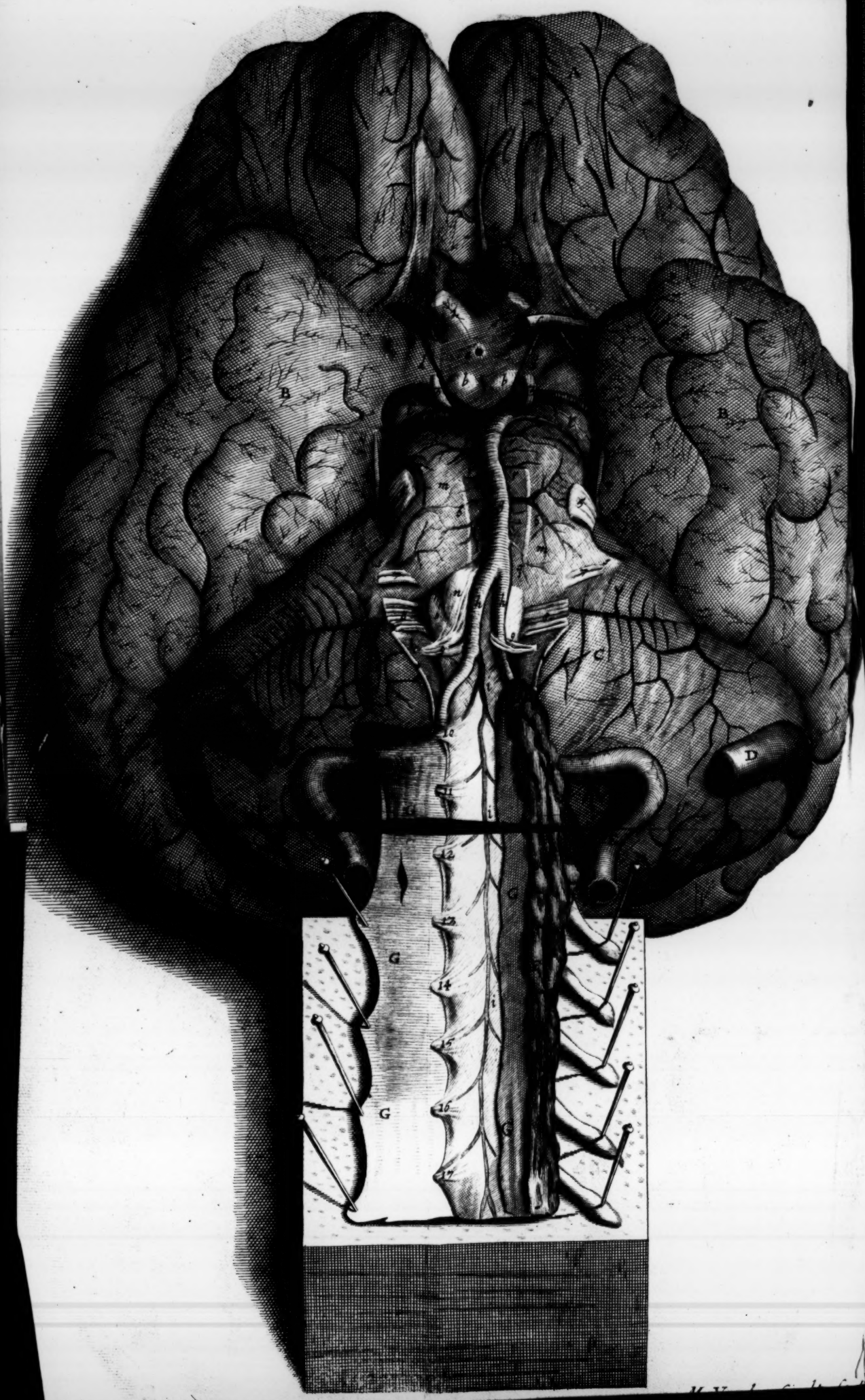
FINIS.

ERRATA.

PAGE 9. l. 14. for *to* read *towards*; p. 16. l. ult. for *from which* r. *which from*; p. 32. in the title of the Chapter, for *Veins* r. *Veſſels*; p. 32. l. 13. after *Veins* inſert *which laſt have already been treated of*; p. 64. l. 5. dele *only*; p. 89. l. 16. *Vitrious* r. *Vitrous*; p. 92. l. 29. for *Septometry* r. *Leptometry*; p. 102. l. 3. for *contracted* r. *contracts*; Ibid. l. 29. for *reflexed* r. *relaxed*; p. 109. l. 18. for *haſtening* r. *happening*; p. 117. l. 28. for *Semicirculari* r. *Semicirculare*; p. 119. l. 12. for *becomes* r. *become*; p. 138. from *And therefore* in the 7th line to the end of that Paragraph, leave it out: p. 137. l. 7. for *above* r. *below*; p. 168. l. 8. after *paſſage* add *at leaſt but very little.*

Fig: 11.



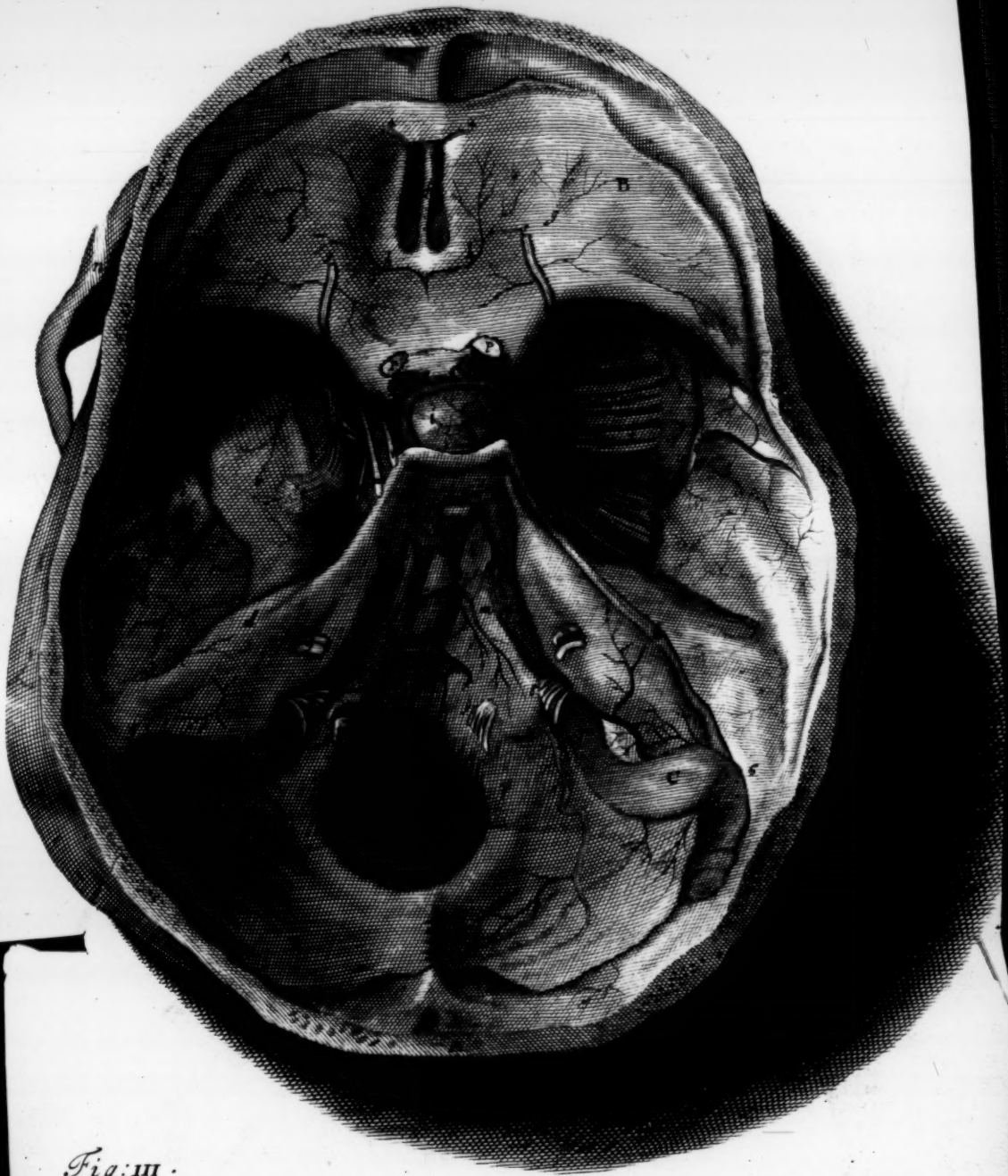


Fig: III.

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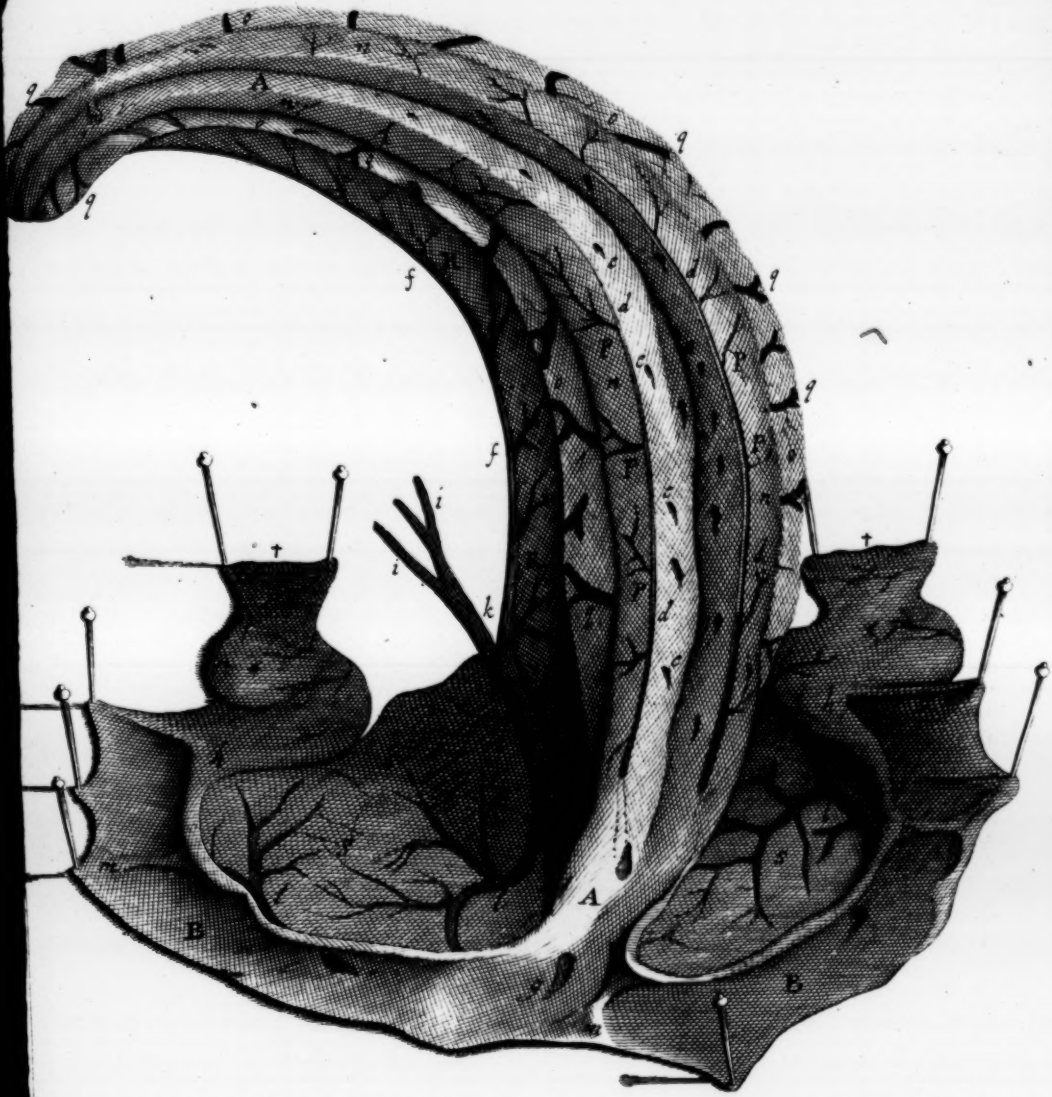
Fig. IV.



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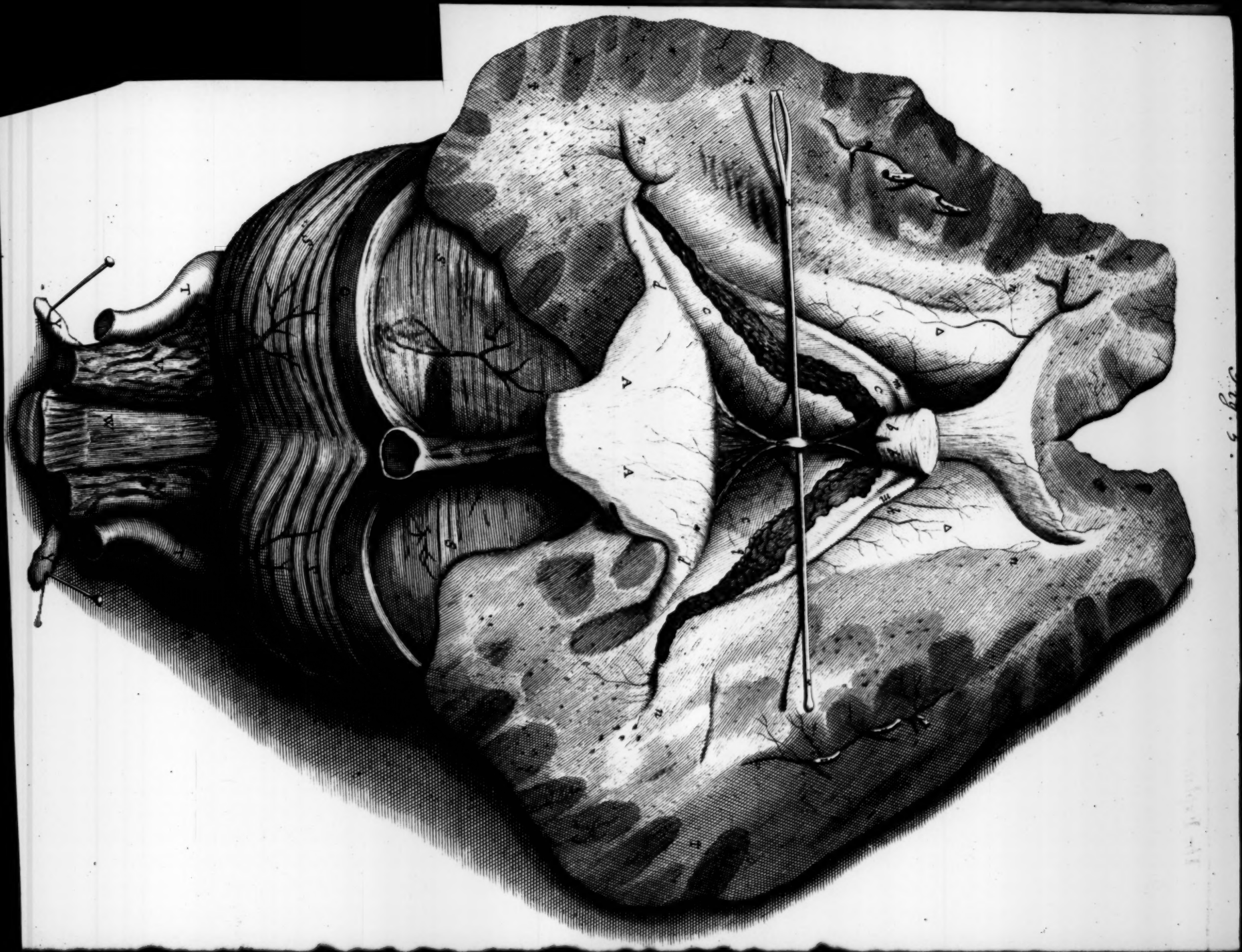
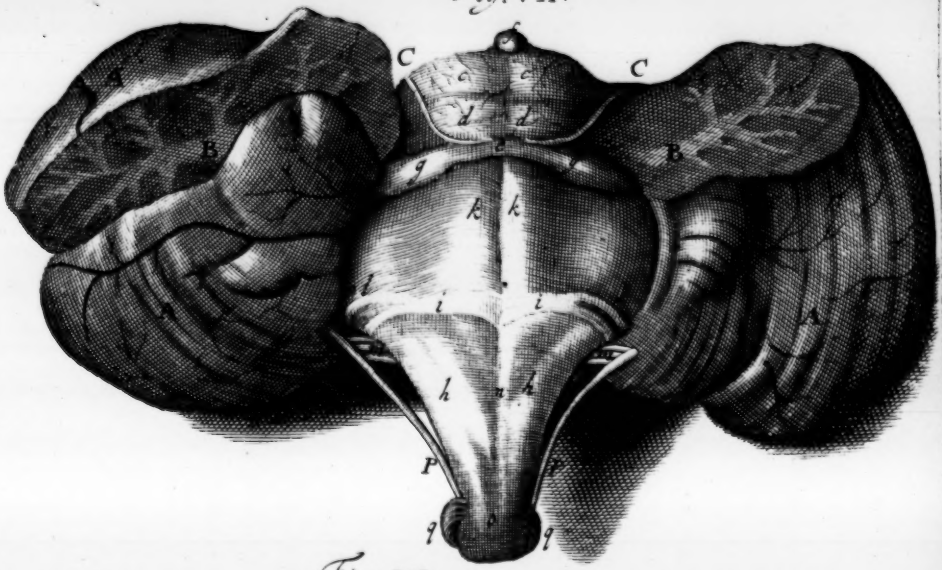
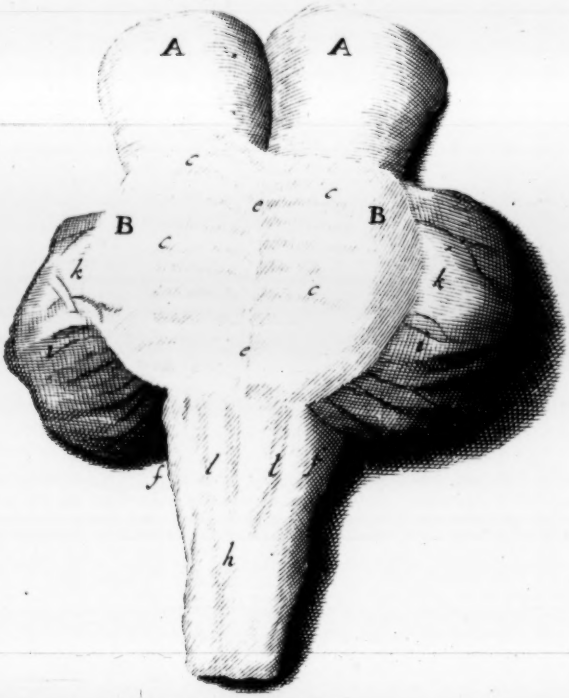


Fig: VII.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